WISCONSIN
HIGHWAY COMMISSION

BULLETIN NO. 16

HIGHWAY MAINTENANCE

Devoted especially to Maintenance on the

STATE TRUNK HIGHWAY SYSTEM

Compiled by N. M. Isabella, Maintenance Engineer

Published for the information of those in charge of Highway Maintenance. Patrolman, Maintenance Foreman, Patrol Superintendents, and County Highway Commissioners should be familiar with its contents.

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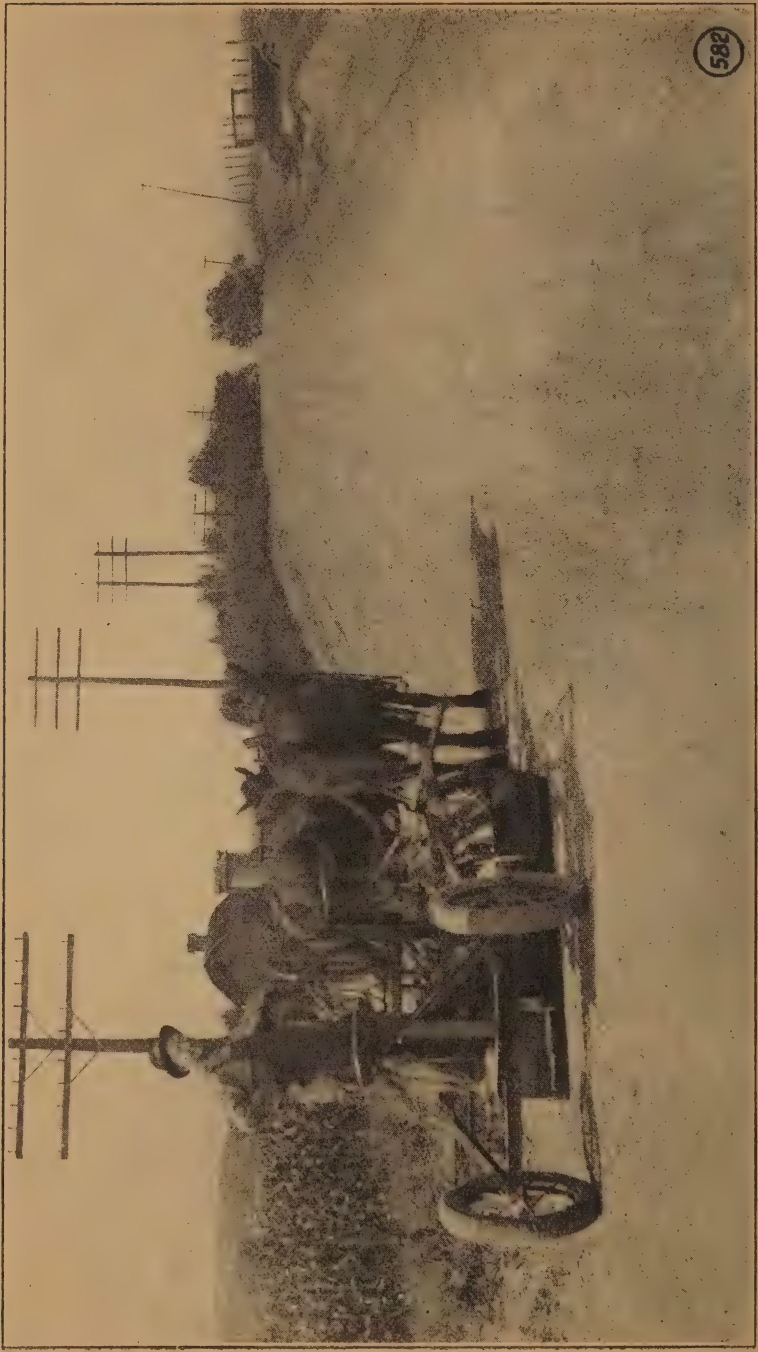


FIG. 1. A standard team patrol. Note the old rubber casings which the patrolman has put on his grader.

HIGHWAY MAINTENANCE

STATE TRUNK HIGHWAY SYSTEM

INTRODUCTION

An attempt is made in this bulletin to give a brief description of some of the methods considered as best practice in the maintenance of highways and structures, but the man in charge of the work must draw upon his own experience, good judgment, and common sense in carrying out many of the details that necessarily must vary in the different localities. It is not intended, nor could it be expected, that this brief treatise on highway maintenance would give all the details necessary for all kinds of maintenance and repair work.

This bulletin should be especially helpful to new patrolmen, foremen and highway commissioners who lack practical experience in maintenance work and who may frequently wish to refer to reading matter on this subject. It is intended that its contents will furnish to the reader such a discussion and also give him other information relative to highway maintenance in Wisconsin; hence the subject matter should be a helpful guide to the patrolman, foreman and commissioner in the absence of sufficient personal instruction from the higher official under whom he works. The instructions herein given and the methods outlined are especially intended for rural highways and for this reason they may not in all cases be applicable to city streets.

Arrangement. The subject matter is devoted especially to the maintenance of the State Trunk Highway System but the principles and methods outlined will apply to practically all highways. An attempt is made to treat each subject under a separate heading. To avoid duplication, those items which apply to all types of roads, such as drainage, erosion, shoulders, etc., are discussed under a general heading.

Classification of Highways—Finances, Etc. A brief statement is given on the classification of all highways in Wisconsin, outlining the principal features of the federal, state, county and town highway systems, together with a statement of the laws governing the financial provisions for their construction and maintenance.

Maintenance Policy. The maintenance policy of the Wisconsin Highway Commission is set forth in a general way. Space does not permit giving all details.

Organization, Patrolmen, Equipment. A short description is given of the plan under which the maintenance work is executed. The state and county organizations are described, also the cooperative plan which has made highway maintenance in Wisconsin so successful. A chapter is devoted to the qualifications, duties and responsibilities of the patrolman, the main cog in successful highway maintenance. Maintenance equipment necessary for good maintenance work is briefly discussed.

Maintenance of Each Type of Surfacing. A chapter is devoted to each class of road and to drainage structures and miscellaneous other structures. It is believed that by discussing each type separately, reference to any particular item may be made more easily and with less chance of confusing the reader.

Cuts, Plates, Sketches, Etc. Cuts, plates and sketches illustrating the methods employed and the results desired are used freely throughout. It is hoped that by combining the reading matter with the illustrations, a clearer conception of the work may be gained.

Statistical Information, Reports. In the back of the bulletin will be found Tables and other compilations of interest to those employed in Maintenance Work.

Miscellaneous. Other information, such as auto registration, traffic counts, safety on the highways, snow removal, etc., are briefly discussed.

CHAPTER I

WISCONSIN HIGHWAYS

System of Highways:

The total mileage of highways in the state of Wisconsin is approximately 78,000 miles, of which approximately 22,000 miles are on the County Systems of Prospective State Highways and as such are eligible to receive county aid. Of these 22,000 miles, 10,000 miles are State Trunk Highways, which, in addition to being eligible to construction with state aid, receive the maintenance allotment from the state, which under present law (1926) ranges from $300 to $500 per mile per year. The counties of the state have voluntarily assumed systematic maintenance of approximately 10,000 miles of county trunk highways. We now have in the state of Wisconsin approximately 20,000 miles of systematically maintained highways. Of the 10,000 miles on the State Trunk Highway System, approximately 5,500 miles are Federal Aid highways which are not only eligible to receive state aid and the regular allowance for maintenance, but are also eligible to construction by the State and Federal Government under the Federal Aid Law.

Considered from the reverse direction, we have approximately 5,500 miles of Federal Aid highways which are also State Trunk highways eligible to construction with Federal aid under the Federal Aid law and with State Aid under the State Aid law, and entitled to receive the regular state trunk highway maintenance allotment. We have an additional 4,500 miles of State Trunk highways which are not eligible to construction with Federal Aid, but are eligible to construction with State Aid, and entitled to receive the state trunk highway maintenance allotment. We have approximately 12,000 miles more of prospective state highways which may receive neither Federal Aid nor the trunk highway maintenance allowance, but which are eligible to construction with county aid. The remaining 56,000 miles (approximately) are town roads, which are improved by the towns. They are entitled to the $25 per mile per year allowance for local roads hereafter mentioned. The county is required to pay 50 per cent of the cost of all except the smallest bridges. The county trunk highway systems were laid out by the county boards under the general authority of the county to construct or improve any road or bridge in the county. In most cases they coincide with the county systems of prospective state highways. By Chapter 11, Laws of 1925, these systems were validated and confirmed, and financial provision for their improvement made as hereinafter explained.

CONDITION OF HIGHWAYS

The mileage of the various types of road on the rural highways of the state is approximately as follows:

Concrete or equivalent	2,150 miles
Macadam (all types)	800 miles
Gravel, shale, mine tailings and disintegrated granite	24,000 miles
Miscellaneous surfacings	2,500 miles
Earth road	48,550 miles
	78,000 miles

FEDERAL AID HIGHWAY SYSTEM

The federal statutes of November 9, 1921, provides that before any projects are approved in any state, such state through its highway department shall select a system of highways not to exceed seven per cent of the total highway mileage of the state, at the time of the passage of the act, and upon this system all Federal Aid apportionments shall be expended. The selection of the Federal Aid System in Wisconsin was made from roads on the State Trunk Highway System by the Special Legislative Committee and the Highway Commission jointly, in connection with the 1923 layout. The seven per cent limitation imposed by the Federal statute held the mileage of this system down to 5,508 miles, of which 2,330 miles are primary, and the 3,178 miles secondary.

STATE TRUNK HIGHWAY SYSTEM

Layout:

As first laid out in 1917 this system was limited to 5,000 miles and required to inter-connect all county seats, and cities with a population of 5,000 or more. The layout was made by a Special Committee of the Legislature appointed by the Governor and the State Highway Commission. The system was increased to 7,500 miles in 1919 and again to 10,000 miles in 1923, and the same procedure with regard to the layout followed in each case.

Marking and Signing—Maintenance:

Previous to the layout of the State Trunk Highway System there was no system of highways in the state serving more than strictly local purposes. The statute of 1917 authorizing the layout also provided that the system should be marked, signed and maintained beginning May 1, 1918. This provision included the entire system, whether improved or unimproved.

When taken over for maintenance, the State Trunk Highway System consisted largely of narrow, unimproved and unsurfaced roads. Each year a certain mileage has been built and improved so that at the end of the 1925 construction season the State Trunk Highway System consisted of the following types:

Portland cement concrete	1,821.5	miles
Bituminous macadam	111.6	"
Stone macadam	145.7	"
Gravel, bituminous treated surface	410.8	"
Gravel, plain	4,834.3	"
Mine tailings	76.3	"
Disintegrated granite	114.0	"
Shale	311.7	"
Sand–Clay	152.0	"
Earth road, including top soil	2,322.1	"

After careful study and consideration the Highway Commission adopted and put in effect for the first time the number system of marking the highways, now so well known, not only in Wisconsin, but all over the civilized world. This met with immediate success and has since been adopted by a majority of American states. To avoid confusion resulting from double numbering, the county maintained highways are marked by letters.

Though there has been much improvement in the details of marking and signing, the fundamental ideas are the same. The principal idea is that the State Trunk Highways are distinguished by numbers which are shown on the various maps published by the State Highway Commission. These numbers appear on signs and markers along the roadside. The traveler can select his route from any one of the maps and drive to his destination by following the numbers shown on the map. At the proper places there are direction and warning signs for the guidance and protection of the traveler.

One of the most important developments are the "shape" and "night" signs. The shape signs convey the desired information by their shapes, which can be distinguished long before the inscription on the sign can be read. The night signs are placed especially for convenience in night driving. A complete statement including cuts of all signs will be found in the Marking and Signing Bulletin issued by the Highway Commission.

The State Trunk Highway System is maintained by the counties under the supervision of the State Highway Commission. When any county has maintained the portion of the System within its limits, in accordance with the regulations of the Commission, the county is reimbursed to the extent of the maintenance allotment. This is $500 per mile per year for primary federal aid highways, $400 per mile per year for secondary federal aid highways and $300 per mile per year for the remainder of the System.

FINANCES

The expense of all state highway activities, both construction and maintenance, is paid from the proceeds of motor vehicle fees, the tax on gasoline, and federal aid. Financial aid is also extended to the counties, cities, villages and towns. After the cost of collecting the motor vehicle fees, and the gasoline tax has been paid the net proceeds are combined with the Federal Aid allotted to the State, and the total fund (estimated at $14,393,000 for the fiscal year ending June 30, 1926), is annually distributed as follows:

(1) The sum of $100,000 is appropriated as an administration fund for the Highway Commission.

(2) Ten per cent of the remainder is set aside for the improvement of the State Trunk Highway System, in such places as the Highway Commission shall determine.

(3) The sum of $100,000 is set aside for marking and signing the State Trunk Highway System.

(4) Allotments are made for maintaining the State Trunk Highway System, as follows:

Primary Federal Aid Highways, $500 per mile.
Secondary Federal Aid Highways, $400 per mile.
Other State Trunk Highways, $300 per mile.
There is also financial provision for maintaining swing and lift bridges on the State Trunk Highway System.

(5) The sum of $200,000 is set aside for the construction of special large bridges. This is increased to $250,000 after 1926.

(5a) The sum of $25,000 is set aside for improving roads connecting the State charitable and penal institutions with State Trunk Highways.

(6) The sum of $50,000 is set aside for roads in State parks.

(7) The sum of $15,000 is set aside for making investigations of sources of local road materials.

(8) Allotments are then made for the improvement of local roads and streets, open and used for travel, which are not portions of the State or County Trunk Highway Systems, made as follows:

For town roads and village streets, $25 per mile.
For streets in cities of population not more than 10,000, $50 per mile.
Cities of population between 10,001 and 39,000, $100 per mile.
Cities of population between 39,001 and 150,000, $150 per mile.
Cities of population more than 150,000, $200 per mile.

(9) The remainder is set aside for the improvement of the State and County Trunk Highway Systems.

FEDERAL AID

Federal Aid construction is carried out by the state under the supervision of the U. S. Bureau of Public Roads. Federal Aid is allotted to the states—one-third on the basis of area, one-third on population and one-third on mileage of rural post roads. The amount so available to Wisconsin is about 2½% of the total to the U. S., or $1,873,000 for the fiscal year ending July 30, 1925. The state must match the Federal Aid with a like amount, and in addition pay its own engineering costs, and the cost of the new right of way. All construction with Federal Aid must be located on the Federal Aid Highway System.

Provision to match Federal Aid is made from the proceeds of motor vehicle fees and the gasoline tax. The state funds available were not sufficient to match all of the Federal Aid allotted to this state during the four fiscal years ending June 30, 1924, and a considerable fund accumulated to the credit of the state. These old funds are being met, as rapidly as the funds available under the new law (Chapter 11, Laws 1925) will permit.

STATE AID

The funds for the improvement of the State Trunk Highway System remaining after the amounts to meet old Federal Aid have been set aside, are distributed to the counties, 40% in the ratio of motor vehicle ownership and 60% in the ratio of rural highway mileage. Twenty per cent of the amount distributed to the counties is set aside for the County Trunk Highway System (in counties with one-half or more of the state trunk highways paved this may be as much as 50%), and the remainder is used for the State Trunk Highway System. The improvement may be by the state as Federal Aid, or by the county as State Aid, but the amount received by the county is the same in either case.

Maps:

The State Highway Commission publishes four maps, as follows:

(1) The Wall Map. This map is drawn to a scale of six miles per inch. It shows all of the highways in the state,

including township roads. The State Trunk Highway System and the County Trunk Highways are shown in conventions which indicate the type of road. Sold by the Superintendent of Public Property. Price on application.

(2) The Pocket Folder Map. This is drawn to a scale of eight miles per inch and made up in sections like a railway time table for convenience in touring. Only the State Trunk Highways and the principal county trunk highways are shown. There are conventions in colors indicating the type of road. Besides the map the folder contains other information of interest to travelers. Sold by the Superintendent of Public Property. Prices on application.

(3) The traffic Service Map. This is drawn to a scale of eight miles per inch and shows the State Trunk Highway System and the principal County Trunk Highways in conventions indicating types. The traffic service maps are issued weekly to subscribers and purchasers for the purpose of giving up-to-date information with reference to construction and detours. This information is shown by means of over-prints in red and green. Price of single map with over-print, 50 cents; without over-print, 25 cents; subscription for season (May to November), $10.00.

(4) The Number Plate Map. This map is drawn to a scale of 15 miles per inch. It shows the State Trunk Highways and the principal County Trunk Highways in convention indicating the types. For more complete information see the map itself. Each person registering a motor vehicle receives a copy of this map with the number plates.

CHAPTER II

MAINTENANCE POLICY

General Plan. In planning the maintenance of the State Trunk Highway System, the Commission decided at the very outset to install a thorough system of patrol maintenance, supplemented in all counties by small gangs for reconstruction and heavy repair work. They did not advocate a promiscuous regrading of all roads on the system immediately. Those highways which could be maintained reasonably well by ordinary patrol maintenance method were taken care of by this method until funds became available for reconstruction. In order to get the best results, attention was directed to roads which lacked drainage, were narrow, had dangerous turns and which were unsafe in wet weather. The following specific policies were put into effect, and still apply.

1. **Patrol Sections.** The state highways lying in each county are divided into patrol sections varying in length from 5 to 8 miles where teams were to be used. Where motor truck equipment is to be used the sections are laid out approximately 18 miles long and where motor grader or tractor grader equipment is to be used, the sections are laid out from 12 to 15 miles.

2. **Patrolman.** Each section is put under the direct supervision of one man called the "patrolman" and he is to devote all his time to the work for the entire maintenance season which averages about 8 months.

3. **Monthly Salary—Equipment.** Patrolmen must be paid a monthly salary sufficient to attract good men. Where teams are to be used, the patrolman is obliged to furnish the team and wagon and the county furnishes the grader, planer, plow, slip scraper and other necessary small tools. Where a motor truck is to be used, the county furnishes same with a driver, the equipment on this section to consist of a four horse blade grader, two heavy planers and

the necessary small tools. Where a motor grader is to be used by the patrolman, this is furnished by the county. The practice of the patrolman furnishing his own motor grader is not permitted. Where a light tractor is required, the county furnishes practically the same equipment as for the truck section.

4. **Responsibility.** The patrolman is responsible for the maintenance of his section and where extra help is necessary to adequately maintain any particular section this help is furnished by the county but the work is done under the supervision of the patrolman, the basic idea being to place responsibility on only one man, the patrolman.

5. **Reports.** The patrolman must make daily and monthly reports to the county highway commissioner showing the hours worked under the various activities. The monthly report, showing distribution of the labor and materials, is forwarded to the division office by the county highway commissioner at the end of each month. No funds are paid to the county until these reports have been submitted to the commission and approved.

6. **Special Work.** Where special work is necessary small gangs or crews are organized in each county to carry out this work. In most cases this work consists of scarifying and reshaping old gravel and macadam roads, resurfacing, widening and applying a surface treatment.

CHAPTER III

ORGANIZATION

State Organization. In order to efficiently handle the various road problems, the Commission has divided the state into nine divisions, consisting of 5 to 10 counties in each division. The division office which is located at a central point in the territory is in charge of a division engineer with a sufficient force to handle both construction and maintenance in his counties under the general supervision of the central office. Each division engineer has an assistant in charge of maintenance work and an assistant in charge of construction. These men are charged with the responsibility of securing proper execution of the work under their supervision.

County Highway Committee. A committee of three to five men is selected by the county board to plan and supervise the work in the county. This committee, an administrative body and one which acts as a board of directors, has general charge of the maintenance work in the county.

County Highway Commissioner. The work is under the direct charge of the highway commissioner who is also selected by the county board. The commissioner must take his orders from the county highway committee. Frequent meetings are arranged between the division office and the county highway departments to determine the policies to be pursued in the maintenance work. Excellent cooperation has resulted in the past through this method. It is the county highway committee's function to provide sufficient help for the county highway commissioner.

Office Assistant. Every county, however small may be its highway program, should employ an office assistant to keep the records and accounts.

Patrol Superintendent. Where a county highway commissioner has twenty or more patrolmen to supervise besides the various county crews on gang maintenance and construction work, he should be provided with a patrol superintendent to look after the work of the patrolmen.

In many cases it is necessary to have a patrol superintendent even with fewer patrolmen than stated above, depending, of course, on the amount of other work being carried on in the county. It is the duty of the patrol superintendent to supervise the work of the patrolmen under the direction of the county highway commissioner. He should cover all patrol sections weekly or oftener and carry with him supplies such as sharp blades for graders and other small tools. He should work out with each individual patrolman the problems existing on his section and give him the benefit of good methods employed on other sections. The success of the Wisconsin maintenance system has been largely due to this plan of organization and supervision.

Maintenance Engineer and Assistant. The maintenance engineer of the Commission and his assistant in travelling over the state with the maintenance representatives in each division, observe the methods and practices developed in the various counties, discuss them with the various division men and advise the employment of the better methods in all counties. The maintenance assistant in each division in turn carries these ideas to the county commissioner and the patrol superintendent in each county should in turn pass them on to the patrolmen under his supervision. This system gives each patrolman the advantage of the experience of other men throughout the state. It has been through this plan that the efficiency of the maintenance work has increased immeasurably since the beginning of maintenance work and it has been a most important factor in the success of patrol maintenance in Wisconsin.

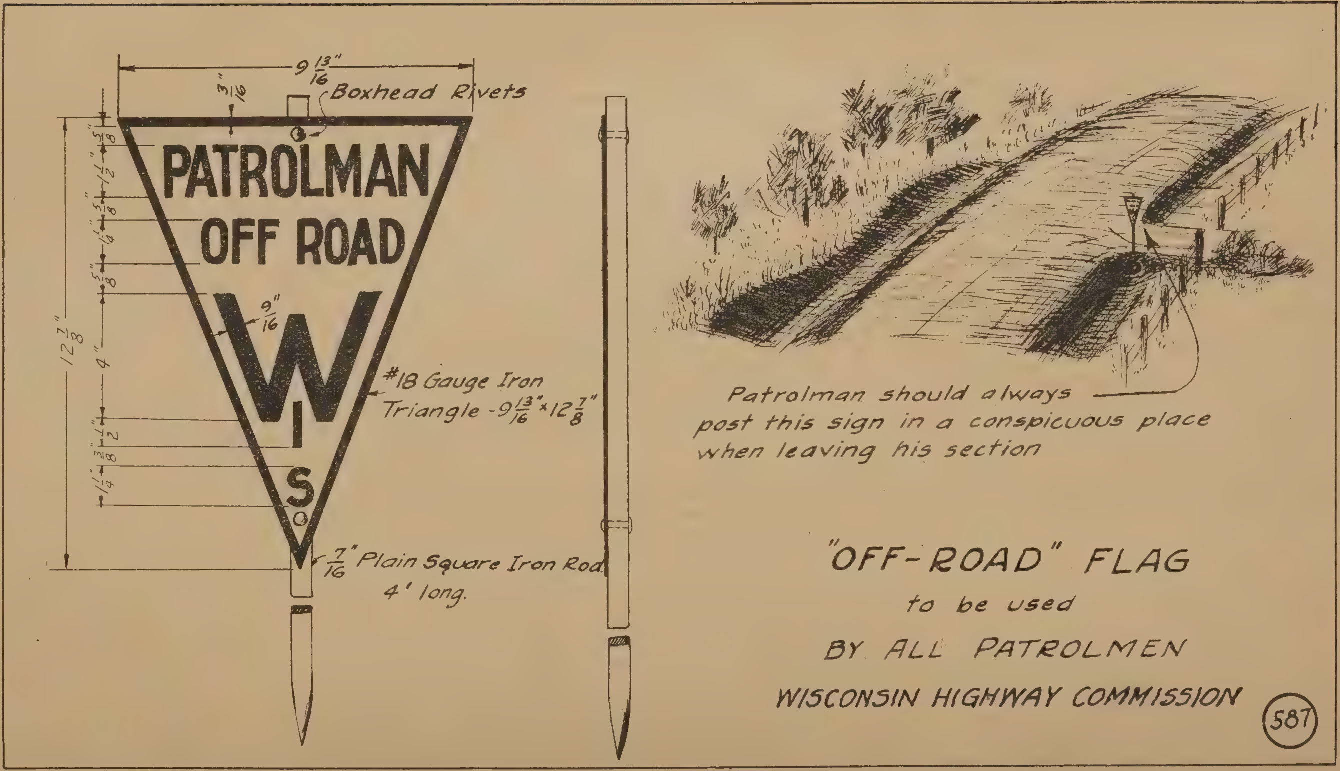


Fig. 1. Patrolman's "off road" flag which must be used by all patrolmen to designate place where he leaves his section.

CHAPTER IV

PATROLMEN

Requirements, Duties, Qualifications. The position of patrolman on the State Trunk Highway System is one of utmost importance to the travelling public and the greatest care must be exercised in selecting him. The job must be sufficiently attractive that the patrolman will take an active interest in his work and remain on the same section from year to year. To attract good men, a monthly salary commensurate with the work to be performed must be paid and the patrolman given steady employment for the entire maintenance season which extends over a period of about 8 months. If conditions warrant, he should be expected to do extra work with pay before or after the regular maintenance season. In order to stimulate the interest of the patrolmen in their work the division engineer and his assistants, when travelling over the various patrol sections, record the conditions of each section and at the end of the season each patrolman is rated as excellent, good, fair or poor. Needless to say, the "poor" class should be weeded out and those in the "fair" class should be brought into the "good" or "excellent" class. In classifying the patrolmen, the following items must be considered:

Condition of section when he took it over; the soil and surface condition; the traffic and weather condition. The men classified in the better class receive more salary than those in the lower class. This plan is an incentive for each patrolman to do his very best and it may be safely said that it has been very instrumental in raising the general standard of the patrolmen. As an additional inducement to give better service, the Commission permits each county to allow the first or best patrolman to attend the annual Road School at Madison with expenses paid.

A patrolman should possess more than ordinary qualifications and ability. He must be honest, punctual, sensible,

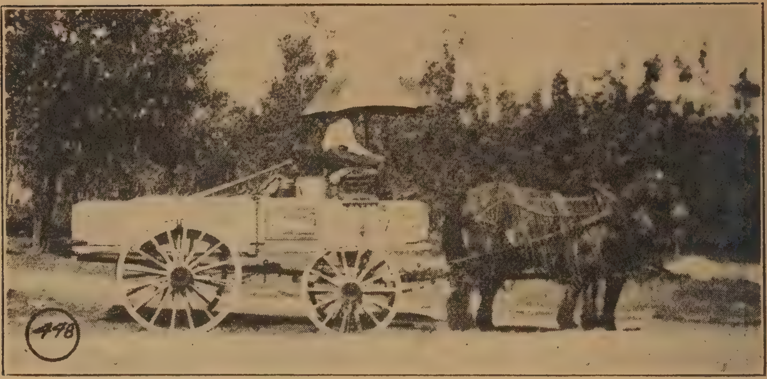


FIG. 1. Patrolman's Wagon displaying standard Trunk Highway Marker.

healthy, industrious and willing to learn. He must have brains and demonstrate to the public that he knows how to use them. In order to be employed by a county a patrolman must fulfill the following requirements and agree:

1. To give his entire time to the work and work 10 hours each day.

2. Where team patrol is used to furnish a satisfactory team and wagon, wear the number badge furnished by the county, mark his wagon box with the standard marker and use the patrolman's flag as directed.

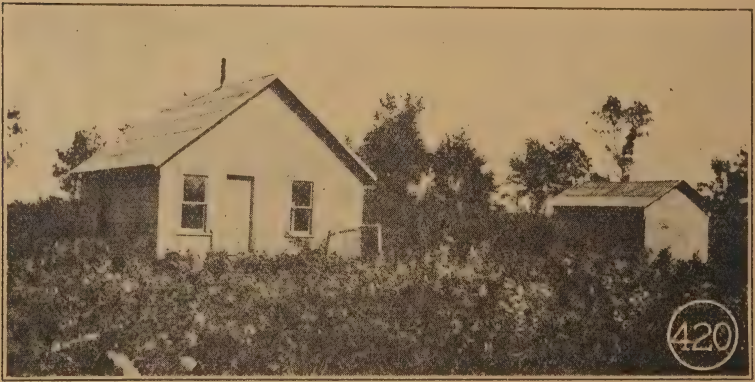


FIG. 2. Patrolman's shack and barn built by the county near the center of a long section where no house was available.

3. To have available at all times a rain coat or "slicker" together with other necessary wearing apparel that will permit working during light showers and rainy weather (excepting only heavy rains and storms).

4. To cover with the blade grader, the entire earth or surfaced sections immediately after each rain ceases, even though it may require working certain Sundays and holidays.

5. To follow the instructions given, especially as to earth roads. (After each rain the center of the road shall be smoothed up before any blade work is done on shoulders.)

6. To keep all ditches and culverts free and open.

7. Not to take time off for shoeing horses, sharpening grader blades or other repair work on days when weather conditions will permit working on the road surface.

8. To be responsible for and keep in repair at the county's expense all machinery and tools assigned to his section and furnish an inventory of the same to the county at the end of the maintenance season. (Machinery or tools worn out or broken will be replaced by the county and those lost must be replaced by the patrolman.)

9. To report violations of motor vehicle laws.

10. To make daily and monthly reports to the county highway commissioner as instructed.

11. To have deducted from his monthly salary the actual time taken off for private business.

12. To display a red lantern on wagon or grader after dark and display a red flag on his equipment at all times. (Flag to be furnished by county.)

13. To be courteous to the travelling public and give information and assistance when necessary. No pay for such assistance is permitted.

14. To execute a bond in the sum of $500.00 under the provisions of Section 289.16 of the statutes.

15. When his section or any portion thereof is under construction, the patrolman must maintain the detour around such construction and see that the detour signs are maintained in their proper place.

It shall be his duty to properly grade and drain the road

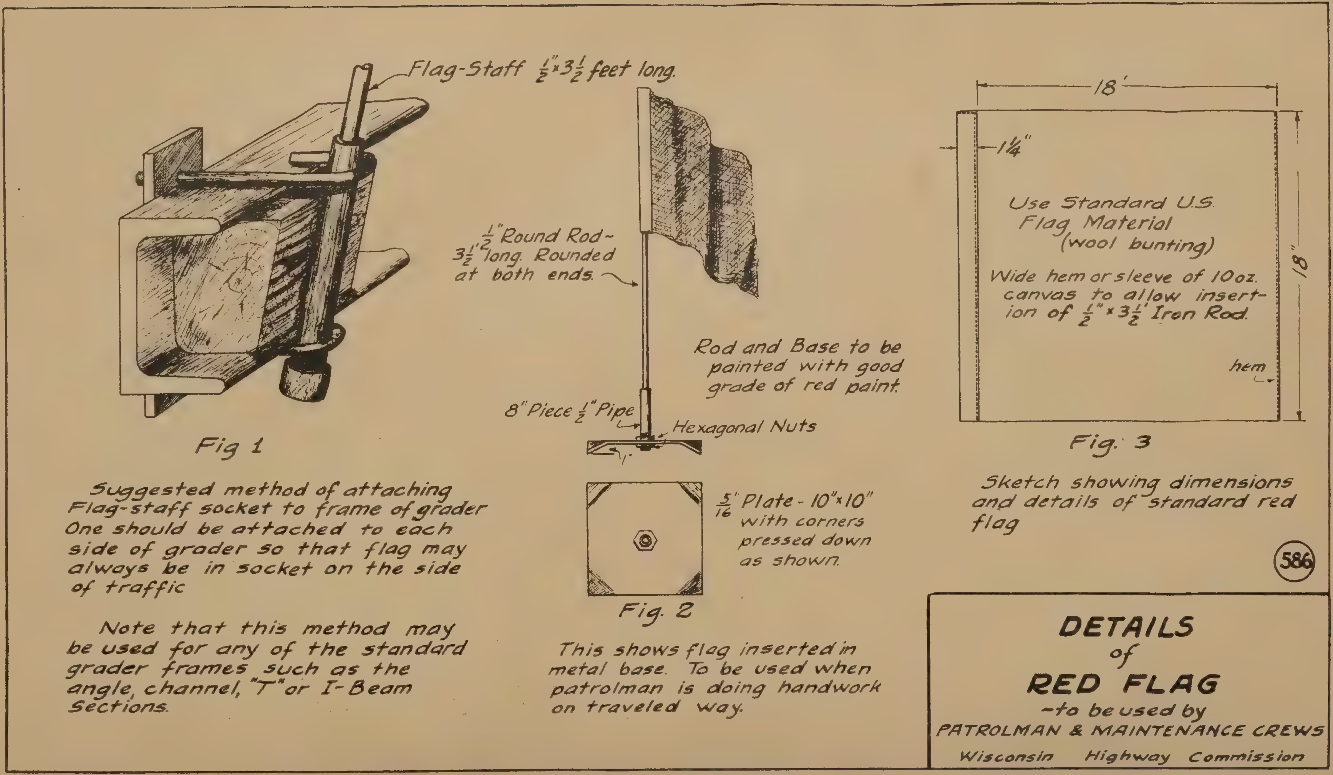

Flag-Staff $\frac{1}{2}'' \times 3\frac{1}{2}$ feet long.
Fig 1
Suggested method of attaching Flag-staff socket to frame of grader One should be attached to each side of grader so that flag may always be in socket on the side of traffic
Note that this method may be used for any of the standard grader frames such as the angle, channel, "T" or I-Beam Sections.
$\frac{1}{2}''$ Round Rod- $3\frac{1}{2}'$ long. Rounded at both ends.
Rod and Base to be painted with good grade of red paint.
8" Piece $\frac{1}{2}''$ Pipe
Hexagonal Nuts
1"
$\frac{5}{16}''$ Plate - 10"×10" with corners pressed down as shown.
Fig. 2
This shows flag inserted in metal base. To be used when patrolman is doing handwork on traveled way.
18"
$1\frac{1}{4}''$
18"
Use Standard U.S. Flag Material (wool bunting)
Wide hem or sleeve of 10 oz. canvas to allow insertion of $\frac{1}{2}'' \times 3\frac{1}{2}'$ Iron Rod.
hem
Fig. 3
Sketch showing dimensions and details of standard red flag
586
DETAILS
of
RED FLAG
-to be used by
PATROLMAN & MAINTENANCE CREWS
Wisconsin Highway Commission

FIG. 1 Details of Red Flag which must be used by all patrolmen.

surface, cut the grass, weeds and brush, maintain a proper cross section with smooth riding surface, and if necessary, to work during light rains on gravel roads at which time more good can be done with less effort than at any other time. He is required to add new material to the surface where necessary; to remove such obstructions as may interfere with vision at dangerous turns and intersections; to make minor repairs on guard fence, riprap, and protect banks and fills by sowing grass seed or by sodding; to maintain detours on his section and to see that signs and markers are kept in place, and minor repairs made when necessary, to familiarize himself with the State Trunk System, Highway Laws and Rules of the Road, places of interest so he may be able to impart this information to the traveling public. He must report all accidents occurring on his section on standard forms furnished him by the Commission. No salary will be paid the patrolman until all reports required of him shall have been received by the commissioner. He must display an "off road" flag or sign when, for any reason, he leaves his section during the day. The location of the "off road" flag will indicate the point on his section where he left the road. It often becomes necessary to drive into a gravel pit to get material and if the patrol superintendent or commissioner, or maintenance representative of the Commission should happen along, it will be impossible for them to locate the patrolman without delay if the "off road" flag is not used.

Patrol Section Sign. In order that the public may know who is actually in charge of each particular section the patrolman's name is posted on a standard signboard at either end of his section, the idea being to place responsibility for the maintenance of each section on the man whose name appears on the board.

Equipment. The patrolman's equipment should consist of a patrol grader weighing from 1200 to 1600 pounds, a road planer, slip scraper, road plow, stone boat, tool box, ax, bar, pick, shovel, and other necessary small tools. In cases where the patrol section is motorized, the county furnishes the tractor, motor grader or truck as the case may be and the patrolman's salary is adjusted accordingly.

Planning Work. A good patrolman always plans his work well in advance, cuts brush, weeds and grass, repairs guard fence, bridge floors, markers and signs, at such times as may be most satisfactory considering the condition of his section.

Materials. On surfaced sections he should be well supplied with a good resurfacing material, stock piled along the side of the road. Other details such as cleaning out culverts, ditches and hauling materials should be taken care of at the proper time. There is no excuse for a patrolman not being on his section and doing some kind of work at all times. There is no section, however perfect it may seem, that does not require some work on it.

Classification of Sections. Since taken over for maintenance in 1918 the State Trunk Highway system has been maintained mainly by team patrols. Traffic is increasing to such an extent that team patrols are entirely inadequate on many highways and to meet this increased burden motorized equipment is being installed in many of the counties. At the end of the 1925 season the 1325 patrol sections on the State Trunk Highway system were being patroled by the following Equipment: 1168 teams, 60 tractor grader outfits, 54 truck-grader outfits, 46 power-graders, 11 miscellaneous power outfits. Many more counties are going into motor driven equipment for 1926.

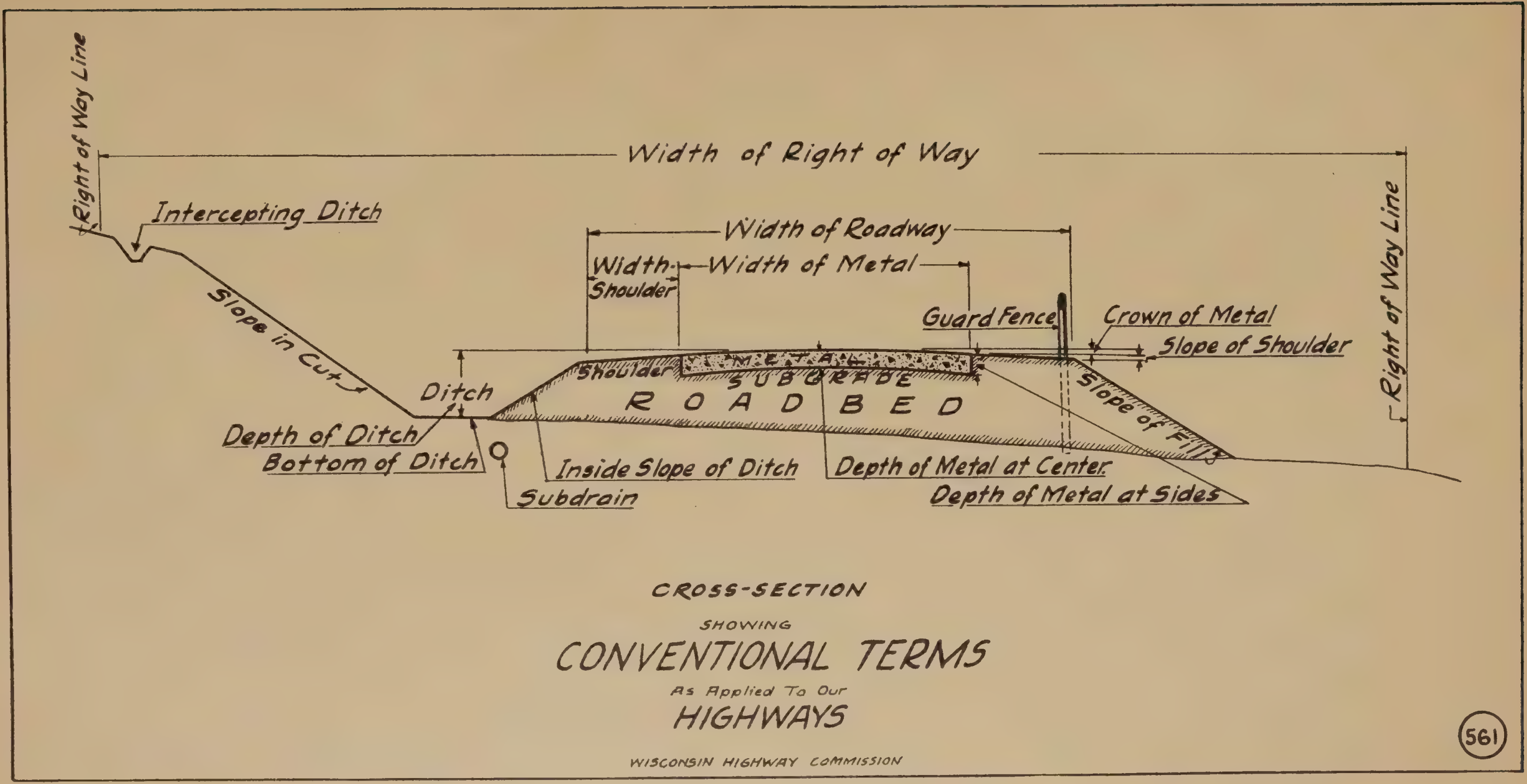


FIG. 1. Standard Cross-section showing conventional terms as applied to our Highways.

CHAPTER V

MAINTENANCE AND REPAIR WORK APPLICABLE TO ALL TYPES OF ROADS

DRAINAGE

Importance of. Too much cannot be said on the importance of good drainage in the economical maintenance of highways. In a great majority of the cases road failures have occurred through the lack of good and proper drainage. The wearing surface of any road is dependent on the foundation underneath, and a well drained subgrade is very essential to the life of any road. Drainage may be divided into two classes, natural and artificial.

Natural Drainage. Natural drainage is that which follows the natural contour. Two of the most important factors in the life of any road are uniform surface and good drainage. Artifical drainage is secured by the crown of the road, by subdrains, side ditches, culverts, catch basins, paved gutters, drop inlets, etc. The subject of bridges and culverts will be taken up in a separate chapter and therefore will not be discussed here. Whether maintenance will be econominal or expensive depends very largely on the foresight of the one who designed the roadway. In locating a road with respect to proper alignment and grade, the matter of drainage is of paramount importance. It often happens that many of the highways have been laid in disadvantageous locations with respect to drainage, and due to the fact that the localities have been well settled and populated, the highways cannot in many cases be relocated to elminate objectionable features.

Artificial Drainage. In practically all cases where a construction project has been completed, the natural course of surface waters is changed or diverted by the new roadbed. This very often adds to the maintenance work necessary in keeping the roadbed in good condition at all times. Where

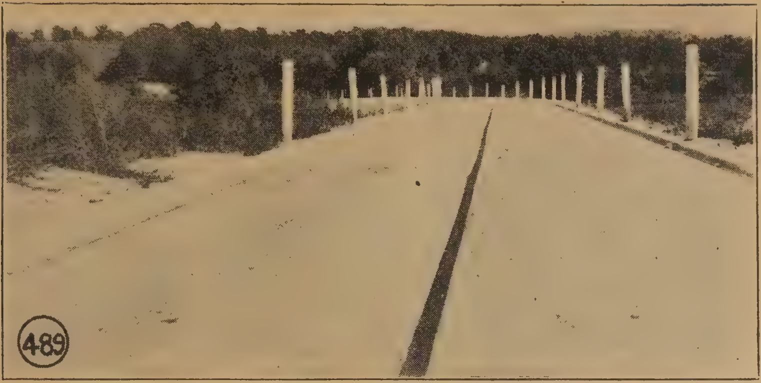


FIG. 1. Curb and gutter section. Water falling on the road itself is enough to cause serious damage to high embankments. The gutter keeps this water on the road and prevents damage to the bank. Note the guard rails posts have not been finished. Walworth County.

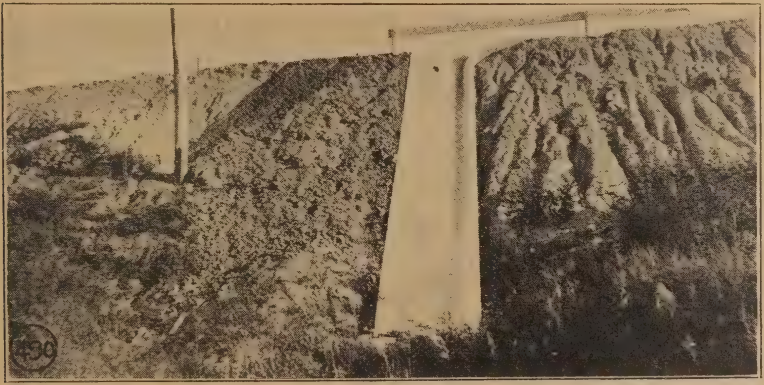


FIG. 2. Discharge from curb and gutter section. Neither the pavement, curb or gutter can be built until the embankment has settled. In the meantime, it is unprotected. Note damage through washing.

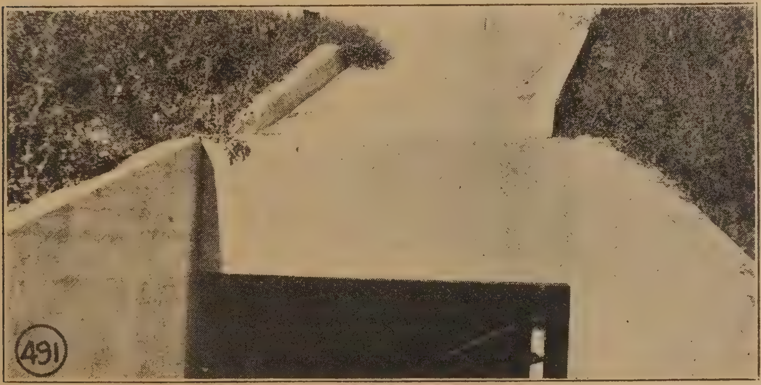


FIG. 3. Discharge from curb and gutter section, directly into culvert opening.

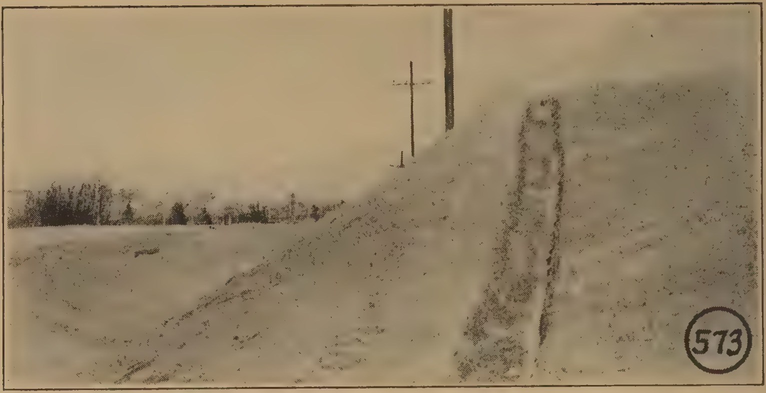


FIG. 1. Showing an intercepting ditch properly placed.

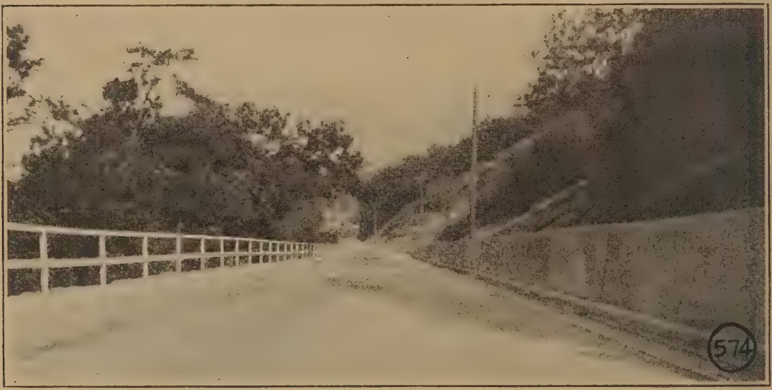


FIG. 2. Showing Concrete retaining wall to keep Sand bank from filling roadway.

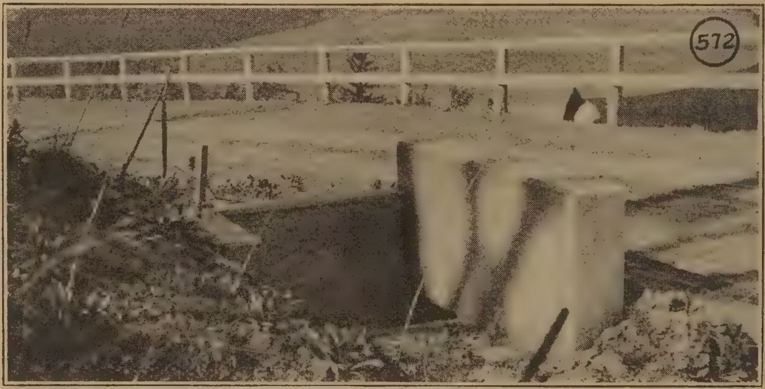


FIG. 3. A drop inlet. Used in hilly country to prevent ditch scour.

the natural course is diverted or changed, to fit the conditions in the field, the drainage may be called artificial.

Crown. Before motor vehicles became common throughout the country, the crown on the rural highway was usually excessive. But this excessive crown is dangerous, and with the increase in motor vehicle traffic, practice was changed. Only enough crown should be placed in the road to allow proper drainage of the surface.

Side Ditches. The cross section for all rural highways provides for side ditches. It is very important that these ditches be kept free from obstructions and kept at the proper depth to allow the surface waters to collect and to be taken away from the roadbed. It is good practice to have outlet ditches at frequent intervals to allow the water to get away from the roadbed. Frequently, when the side ditches are not at the same elevation, the water is apt to seep from the shallow ditch across the roadbed toward the deeper ditch, thus allowing considerable moisture to collect in the roadbed. To set a definite depth or width for side ditches is rather difficult, as the soil conditions vary so greatly over the state.

Capacity of Side Ditches. However, one thing must be kept in mind and that is to have side ditches with sufficient capacity to take care of all the surface waters. In some localities this may mean a ditch 18 inches deep; in others, it may mean 2½ to 3 feet below the crown of the road. Usually structures are designed to take care of maximum conditions and for this reason side ditches should be such as to amply take care of melting snow, spring rains, and also heavy showers during the summer and fall.

Ground Waters. If the side ditches are not kept free and open this will allow the water to accumulate and soak into the roadbed and cause future road surface failures, especially if this condition exists in the fall of the year. Many of the failures that take place in the spring could be eliminated by proper maintenance of the side ditches in the fall of the year.

French Drains. In the construction of the roadbed, future drainage must be anticipated and wherever necessary French drains should be constructed by digging a trench and then filling the trench partly with stone or cinders and

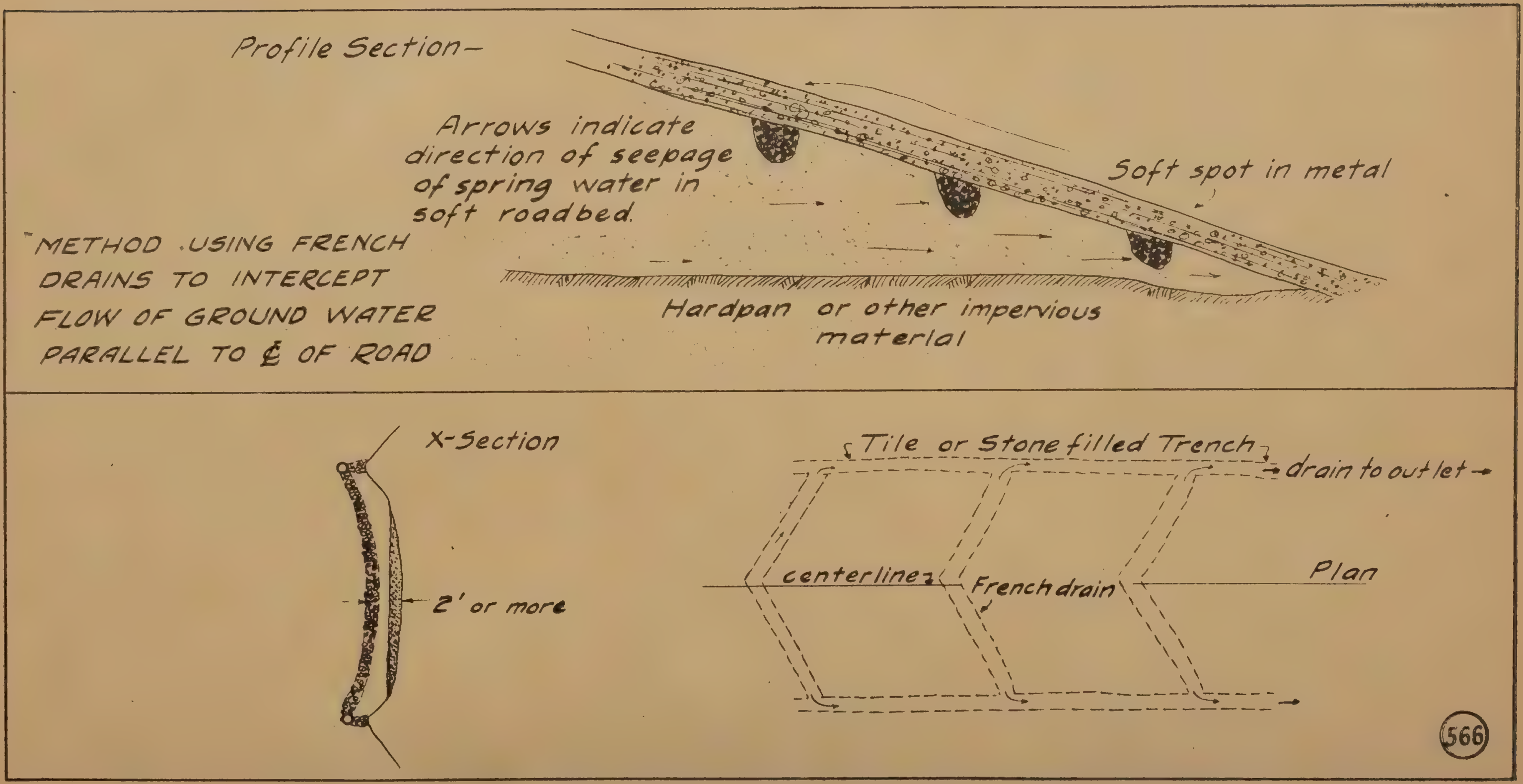

Profile Section—
Arrows indicate direction of seepage of spring water in soft roadbed.
Soft spot in metal
METHOD USING FRENCH DRAINS TO INTERCEPT FLOW OF GROUND WATER PARALLEL TO ℄ OF ROAD
Hardpan or other impervious material
X-Section
2' or more
Tile or Stone filled Trench
drain to outlet
centerline
French drain
Plan
566

FIG. 1. Showing method of taking care of ground water in heavy soils.

placing straw and the regular earth on top of the cinders. If these have not been taken care of at the time of construction, it then becomes necessary to build these drains under the maintenance activities.

Tile or Pipe Drains. Very often soil conditions are such that proper drainage is not procured and it is necessary to use tile or pipe to carry the water away from the roadbed.

Vitrified or concrete pipe are very desireable and when used should be placed to have the following gradients.

4″ pipe, not less than 7 inches drop in 100 ft.
6″ “ “ “ “ 5 “ “ “ “ “
8″ “ “ “ “ 4 “ “ “ “ “

This should be preferably of the bell and spigot type.

EROSION

Effect of. Erosion or the washing of the soil by running water is a very destructive force in tearing down the roadbed and highway structures. The destructiveness of the running water depends largely upon the gradient of the ditches, type of soil, the condition of surface and slopes. In order to protect the roadbed from the forces of erosion, the maintenance work must begin immediately after construction. Large investments of money are made in making cuts and fills to better alignments and grades, but these expenditures may be in vain if proper precautions are not taken to prevent the erosive power of running water from washing away the roadbed.

Seeding Slopes. In order to keep a true cross section, the slopes on cuts and fills should be seeded with grass so that sod will form at the earliest possible date. Once a good sod is started, a big percentage of the troubles caused by erosion are eliminated.

Paving Ditch. Side ditches on grades should be protected by either paving the bottom with stone or concrete or by placing small dams at frequent intervals to slow up the speed of the running water, thus lessening the erosive power. Very often the water from the crown of the road collects at the edge of the surface metal, runs along the edge and does considerable destructive work. This may be

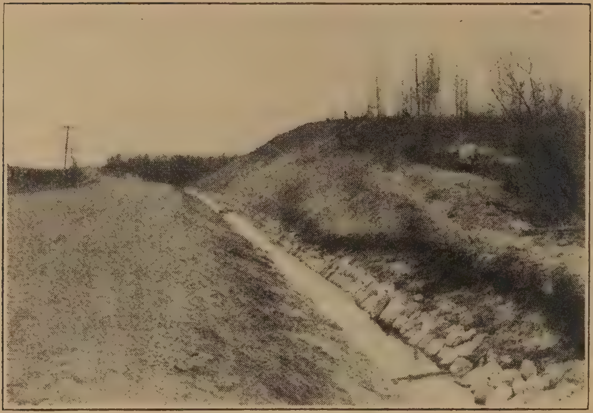


FIG. 1. S. T. H. No. 26 near Summit Lake Langladae Co. Note the paved ditch to prevent erosion.

eliminated by constructing "take-offs" at frequent intervals so that no large amount of water will accumulate.

Catch Basin—Inlets. It will frequently happen that the concentrated storm water reaches the foot of a slope in such volume as to do quite serious damage in passing over the shoulder to the side ditches, or by washing the soil on to a bridge floor. This is especially true on pavements with raised curbs. This water can be taken off the surface by one or two methods—by a catch basin or inlet leading to an underground drain, or by paving a spillway from the edge of the pavement to the side ditch.

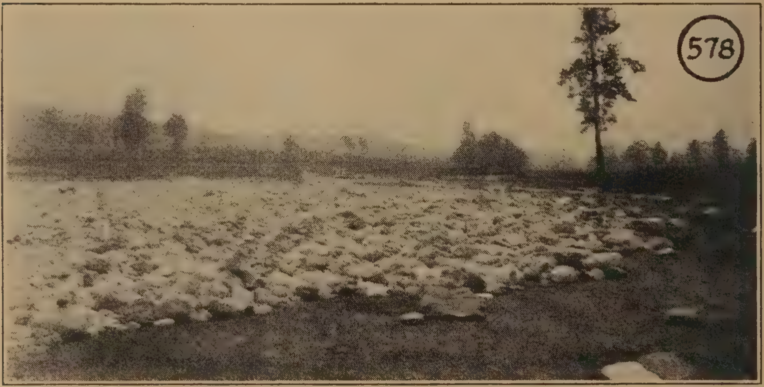


FIG. 2. Showing rocks and debris which have been carried down by flood waters.

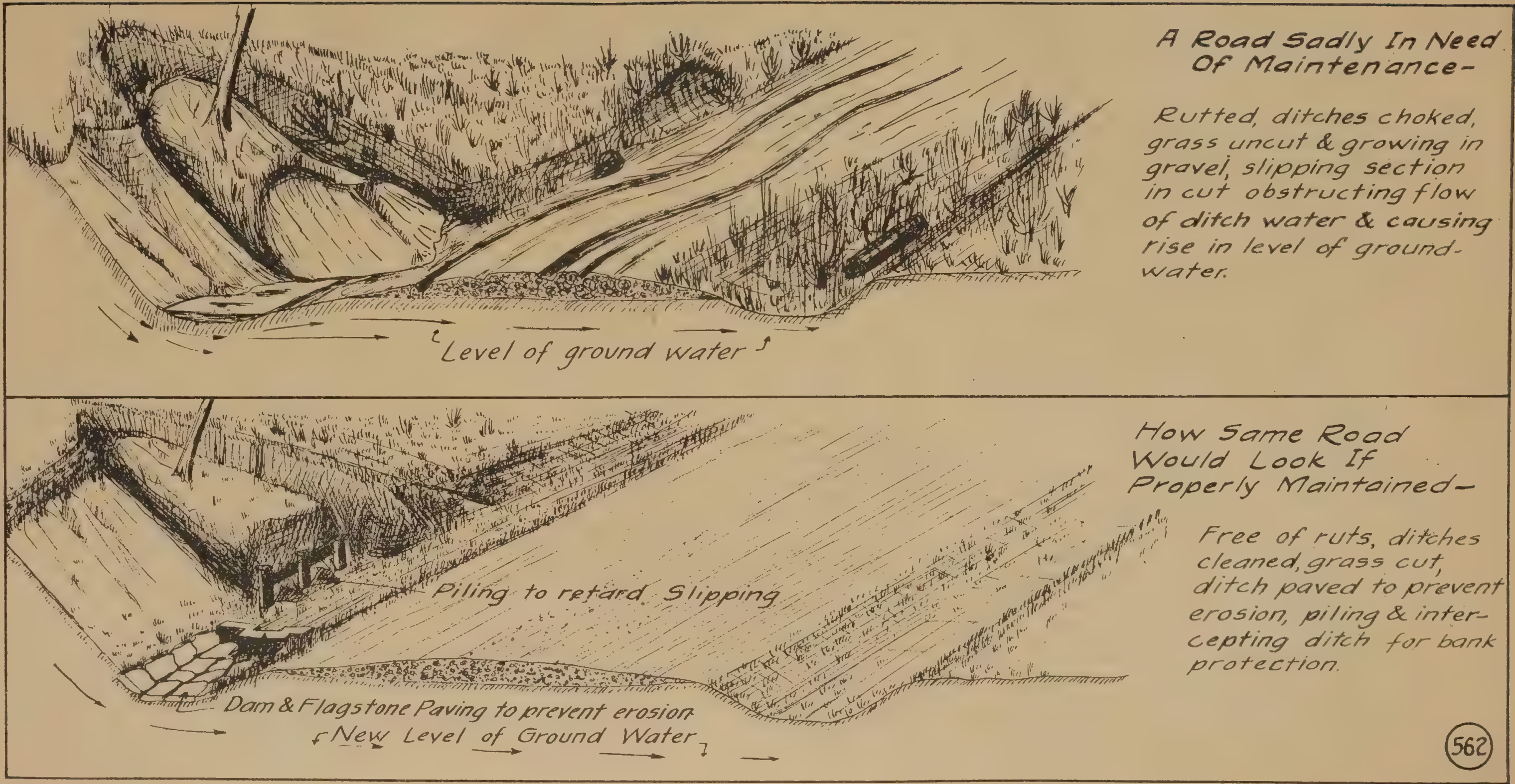

A Road Sadly In Need Of Maintenance-
Rutted, ditches choked, grass uncut & growing in gravel, slipping section in cut obstructing flow of ditch water & causing rise in level of ground-water.
Level of ground water
How Same Road Would Look If Properly Maintained-
Free of ruts, ditches cleaned, grass cut, ditch paved to prevent erosion, piling & intercepting ditch for bank protection.
Piling to retard Slipping
Dam & Flagstone Paving to prevent erosion
New Level of Ground Water
562

FIG. 1. Sketch showing a road in need of Maintenance and same road **after proper methods have been applied.**

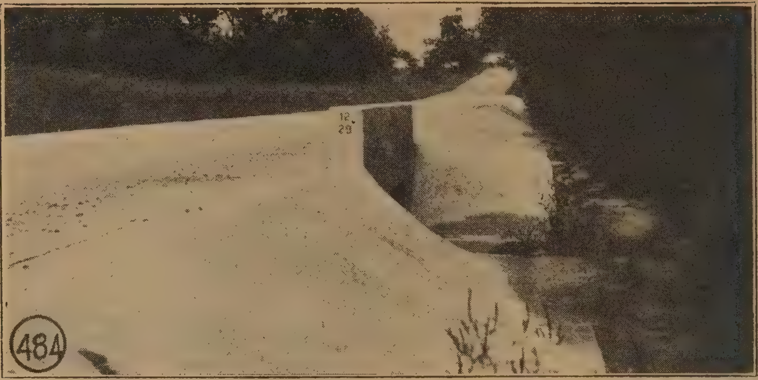


FIG. 1. Overflow section. Though usually dry, there are immense volumes of water for short periods of time. A short piece of concrete road has been built and high water passes over the road without damage.

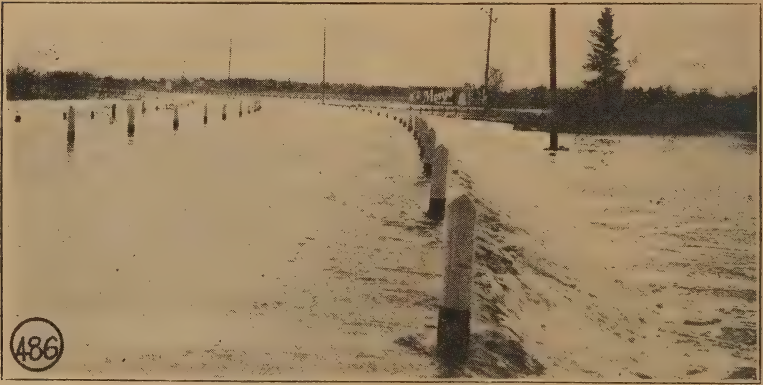


FIG. 2. Overflow waters from Wisconsin River crossing S. T. H. No. 18 west of Stevens Point. Safe limits for travel shown by posts. Riprap protects embankment on down stream side.

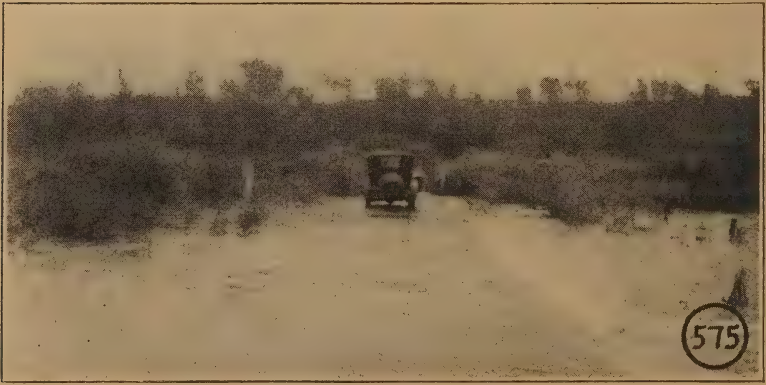


FIG. 3. Showing Concrete overflow section.

Bank and Slope Protection. Ofttimes where a road is in the vicinity of a stream which frequently overflows, the embankments are washed away. Usually these things are anticipated during construction and the embankments are protected against washing by paving, riprapping, or by retaining walls. However, if these things are not taken care of during construction it is the work of the maintenance man to protect the embankment by placing brush mats, or stones to prevent wash. It is often advisable to grow shrubs, vines and small trees at these places, thus tying together the surface soil in such manner that it will not wash away. In many cases the patrolman can use excess stone and rocks that are picked up on his patrol section to lay riprap or slope walls along the embankment. In laying a slope wall, care should be exercised to see that each stone or rock has bearing on at least two other stones. This will insure strength. Where the stream makes a sharp bend near the highway embankment, washouts often occur. The embankment may be protected by building a timber crib and filling this with loose rock or by a timber retaining wall made up of log or plank, by concrete or masonry wall. This procedure, of course, is quite expensive and is feasible only in extreme cases. The growth of brush and small trees will help materially to retard the destructive force of flood waters.

SHOULDERS

Proper Maintenance. The shoulder or that part of the roadbed from the edge of the metal to the side ditch is a very important part of the road. A large percentage of highway accidents is attributable to lack of shoulder maintenance. Shoulders should never be constructed so that the height is above the height of the metal on the surface, and the slope to the side ditch should be sufficiently flat so that the proper cross section may be easily maintained. Most highways are built with earth shoulders and for this reason considerable attention should be directed to their upkeep and maintenance.

Surface Waters-Ruts. Surface waters will wash both toward the side ditches and parallel to the centerline of the

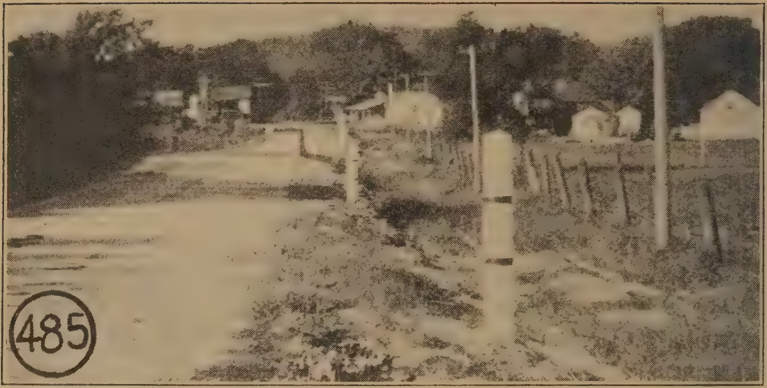


FIG. 1. Overflow section. The black bands painted around the posts show the depth of the water and indicate when it is safe to cross.

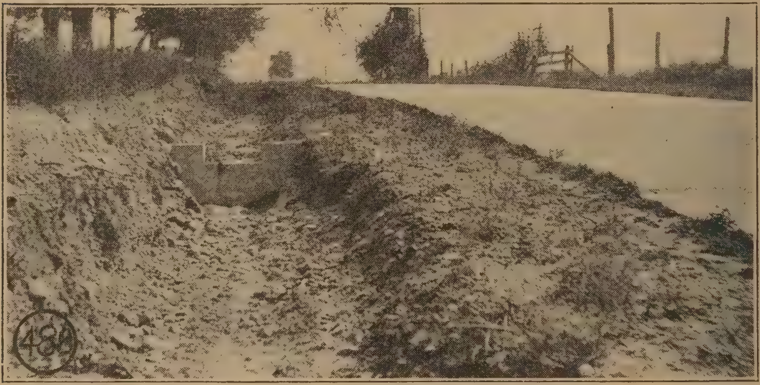


FIG. 2. Erosion baffle, designed to keep the ditch along the road from washing out. The water drops on to a paved surface and runs almost level to the next baffle, where there is another fall on to a paved surface.

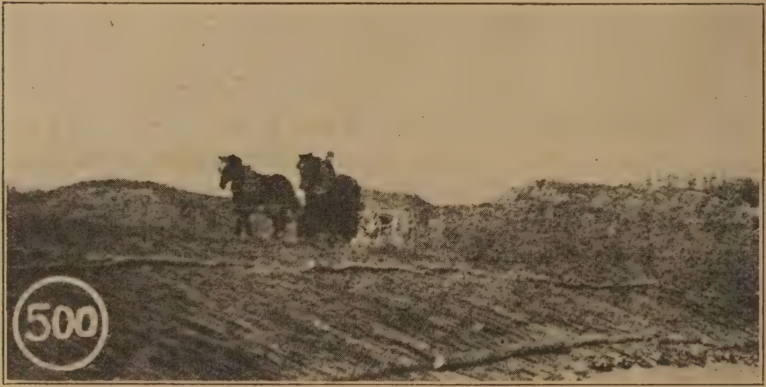


FIG. 3. Brush matting protection. The material in these embankments is usually a coase sand where vegetation scarcely grows. Brush matting protection is necessary to prevent wave action.

road sufficiently to cause ruts and dangerous places. Ruts along the edge of the pavement and road metal may, of course, be taken care of by filling them in with gravel, crushed stone, shale, or other available surfacing materials. The forming of a ditch along the edge of a pavement may be prevented to some extent by building an obstruction at frequent intervals extending from the pavement or surface to the edge of the shoulder. This obstruction may be a stone slab, or a slab of concrete, which will divert the water to the side ditches.

Seeding Slopes. To properly protect the shoulder against erosion and the elements, the slopes should be sodded or seeded. This will permit the true cross section to remain practically in its original condition, and eliminate a large amount of extra work for the patrolman. With the constantly increasing traffic it is imperative that the shoulder be kept smooth, free from ruts, and safe for travel in case additional width is necessary when meeting other vehicles on the highway.

Widening. Many roads have been widened several feet through maintenance operations, and many more miles will be widened in the future. It is very essential that the shoulders are well compacted from the very beginning and that provision be made to retain the cross section constructed. Too often patrolmen and maintenance men are inclined to leave loose earth and rocks along the shoulder, with the result that serious accidents often occur. That portion of the road from the edge of the shoulder across to the other shoulder should always be kept free from any obstacles or loose material. This applies to all types of road.

GRASS, WEEDS, BRUSH, ETC.

Effect of Grass, Weeds, Brush. Allowing grass, brush and weeds to grow along the travelled way has the effect of reducing the width of the highway. Wherever the width is reduced, traffic is bound to be more concentrated in the center of the highway, thus causing excessive wear and increasing maintenance costs. If the weeds, shrubbery, etc. are cut down and not allowed to grow, traffic is spread over the surface of the highway more uniformly, and this requires less intensive maintenance.

Time to Cut. It is the duty of the patrolman to keep the weeds cut down at all times. Very often the argument is advanced that, to cut the small brush and weeds late in the summer will prevent them from growing again during the season. However, the travelled way is used from early spring to late in the fall and in many cases the year around, and the interests of the travelling public must be safeguarded at all times. Therefore, the weeds, grass, brush, etc. must not be allowed to grow but should be cut down at least twice, and in many localities, three or four times during the season.

Trimming Trees, Etc. Brush should be cut down, and trees on the inside of the sharp turns and approaches to railroad crossings should be trimmed to provide good vision across the hazardous places.

Snow Drifting-Increased Maintenance. If brush and weeds are allowed to grow along the roadway, or ditches and banks, and are not cut before the winter season, they will cause snow to drift on the highway or deposit in the ditches and thus increase maintenance work the following spring.

Extra Help for Patrolman. In many cases where traffic is heavy the patrolman is kept so busy that he is only able to take care of the road from ditch to ditch, and in that event additional help or a gang should be used, in removing brush, weeds, and rubbish on the right of way.

SLIPS AND SLIDES

Hilly Country. Slips and slides usually occur in hilly country where deep cuts and fills are very common. Most highways in hilly country are constructed along side hills and the cross section of the grade is partially in cut and partially in fill. When moisture seeps into the earthwork there is a tendency for it to slide. In many cases the sliding of the cut section fills the ditch on the upper side and causes drainage troubles and extra work for the patrolman. When there is a slide on the fill section, the fill usually settles and develops structures and other features of the highway.

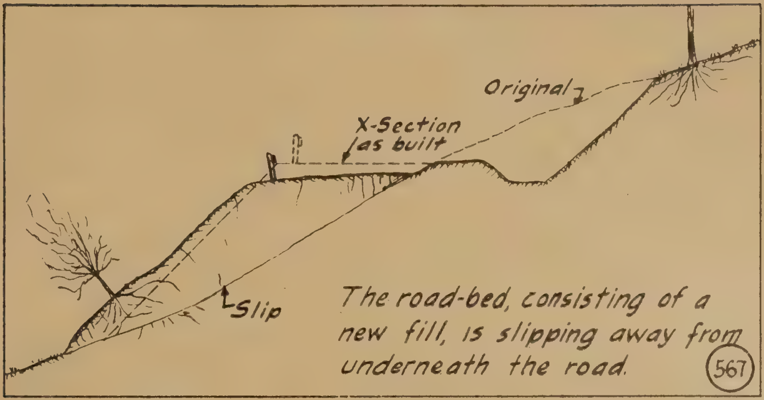

Original
X-Section
as built
Slip
The road-bed, consisting of a new fill, is slipping away from underneath the road.
567

FIG. 1. Shows a side hill fill which has slipped.

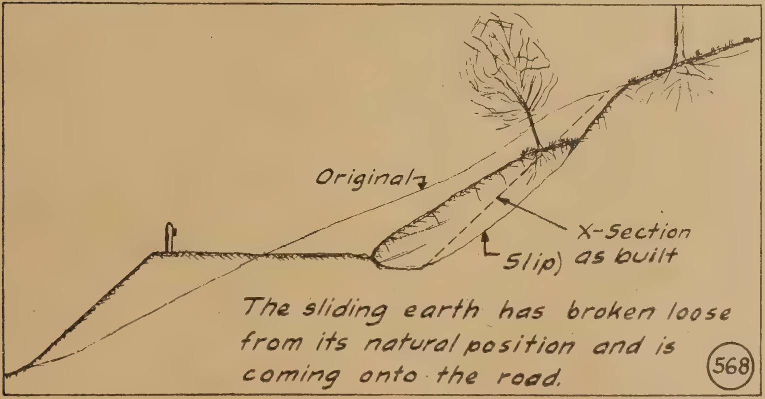

Original
X-Section
as built
Slip
The sliding earth has broken loose from its natural position and is coming onto the road.
568

FIG. 2. Shows bank which has broken away from original position.

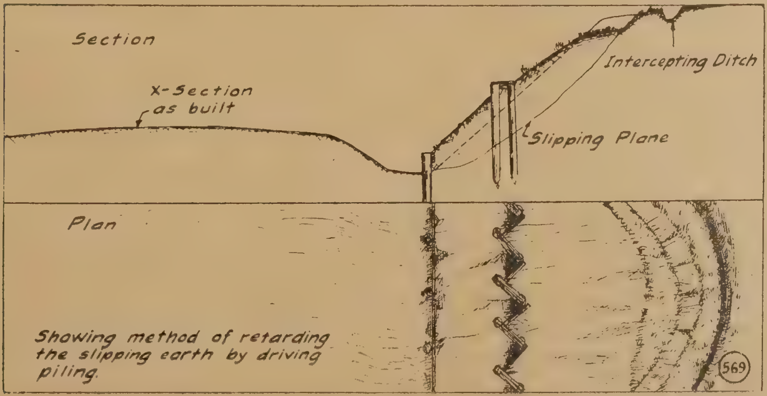

Section
X-Section
as built
Intercepting Ditch
Slipping Plane
Plan
Showing method of retarding the slipping earth by driving piling.
569

FIG. 3. Shows method of retarding the slipping earth by driving piling.

Each A Special Case. One can scarcely draw a hard and fast rule covering all cases. Each one must be considered a special case, as there is a great variation in soils. It is very essential, however, to keep the earth dry and free of moisture so that the earthwork will not have a tendency to slip.

Intercepting Ditch. In many cases, sliding may be prevented by building an intercepting ditch above the cut so that the run-off waters will be diverted to the natural drainage course.

Let Earth Take Natural Course. Generally speaking, the best practice to follow is to allow the earth to take its natural course and then make provisions to prevent further sliding.

Retaining Wall, Explosives, Etc. This may be taken care of in the case of cuts by a retaining wall, or by placing an obstruction with piling, planked on the one side. In some cases slides may be prevented by roughening the slipping plane by the use of explosives.

Keep Moisture Out. There is one principle, however, that will apply in practically all cases and that is to keep the moisture and ground water out of the earth that is apt to slide.

The plates on page 45 show how slides occur and how they may be retarded.

FROST BOILS

Where They Occur. Frost boils are very common in states of the latitude of Wisconsin. They occur on practically all types of roads and for this reason they will be discussed under this chapter.

They seem to occur more often in the northern section of the state where the frost occurs earlier in the fall and does not leave the ground until late in the spring. It is also true that where the surface or crust of the road is of a light nature that they occur very frequently. Where surfacing has considerable strength, such as in bituminous roads and concrete roads, they do not occur very often.

Cause. Opinions seem to differ as to what is the exact cause of frost boils, but all seem to agree that they are very destructive to the road surface, and impede traffic to a great degree in the spring of the year. Counties should anticipate the location of frost boils and should be prepared to remedy conditions as soon as they occur. They should have rock 4″ to 8″ in size stock piled near bad places in road so it may be used when necessary.

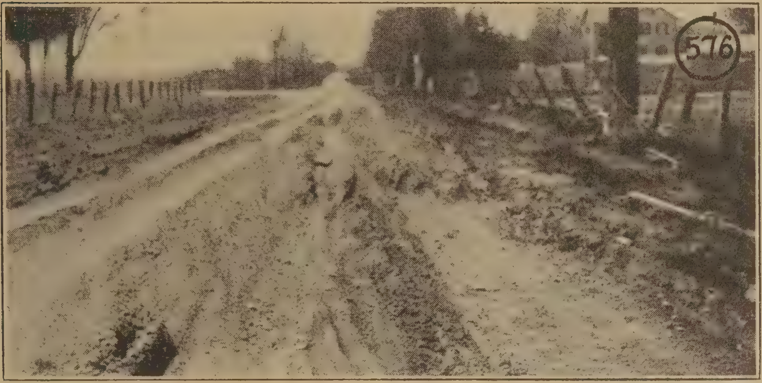


FIG. 1. A good gravel road which is undergoing spring frost conditions.

Remedy by—Trenching, Planking, Brush Mats, Explosives. In many cases commissioners have noticed "frost boils" making their appearance early in the spring and before the "boils" reached any great proportion, they immediately trenched one-half of the road from the center toward the side ditch and allowed the road to drain out toward the side. One-half of the road was closed to traffic, and immediately after drainage was started to the side, the trench was filled with stone or cinders and then traffic was allowed to move over the entire road. It is often necessary to repeat this operation with the other half of the road. Some commissioners have resorted to the use of explosives to open up the frost boil and allow it to dry out, after which they filled it with gravel and other dry materials.

In cases where neither of these two methods are applicable, the road has been planked and traffic allowed to move over it. Two 3 inch planks spiked together with cleats and then spaced 4′–8″ center, will carry reasonably heavy traffic.

The use of small brush laid at right angles to the centerline of the road has also been quite successful.

Draining Surface, Side Ditches. It is very essential in the case of all frost boils to see that the side ditches are opened up properly to allow the water to get away from the road. Where considerable water exists on the surface of the road and ruts have been formed by traffic, shallow side trenches can be made by the patrolman to allow the surface water to run off instead of soaking into the roadbed.

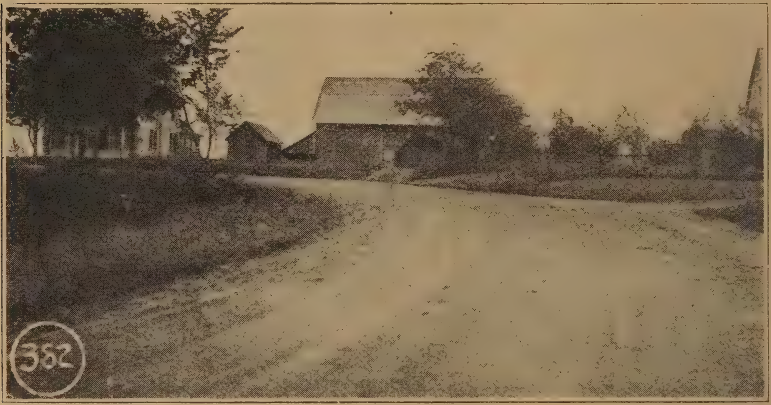


FIG. 1. A well maintained road. Trunk Highway 28, near Reedsburg, Sauk County. Note the manner in which the trees are trimmed at the turn.

ROADSIDE BEAUTIFICATION

Natural Scenery—Importance. One of the greatest assets that Wisconsin has is the natural scenery which is so prevalent in all sections of the state. The highways are used to a large extent for pleasure and it is very essential that the right of way and roadside be very attractive to the motorist. European countries learned years ago the value of beautiful shade trees and have for many years been planting additional trees along the highways, roadsides, and parks. The problem of roadside beautification is becoming a very important one in Wisconsin, especially in those sections which are well settled and highly developed agriculturally. The patrolmen or maintenance crews should be very careful about cutting trees along the right

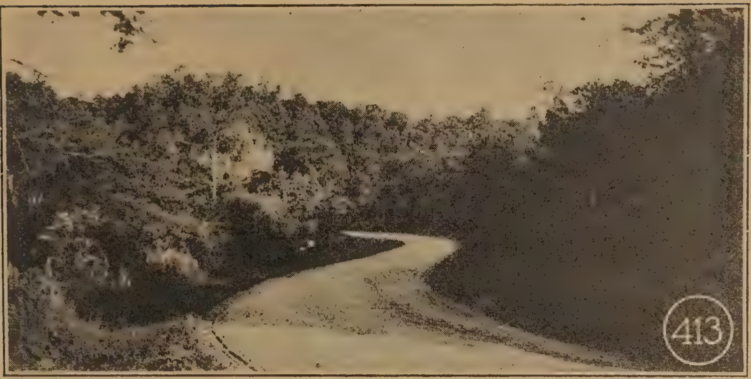


FIG. 1. A gravel road in Pierce County.

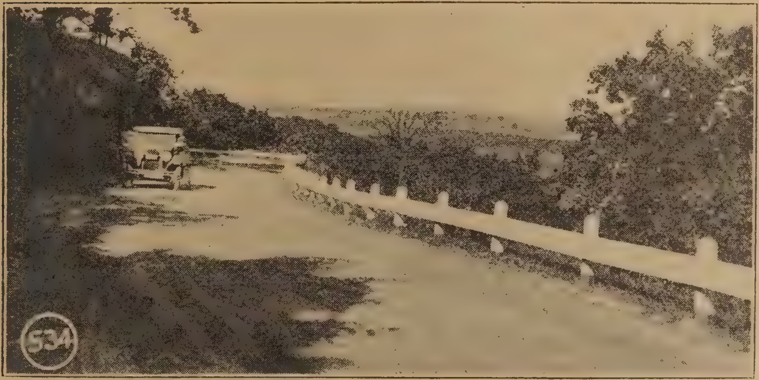


FIG. 2. New type guard rail. The longitudinal plank is at the height of the hub of a motor car. Scene in Trempealeau County. S. T. H. 93.

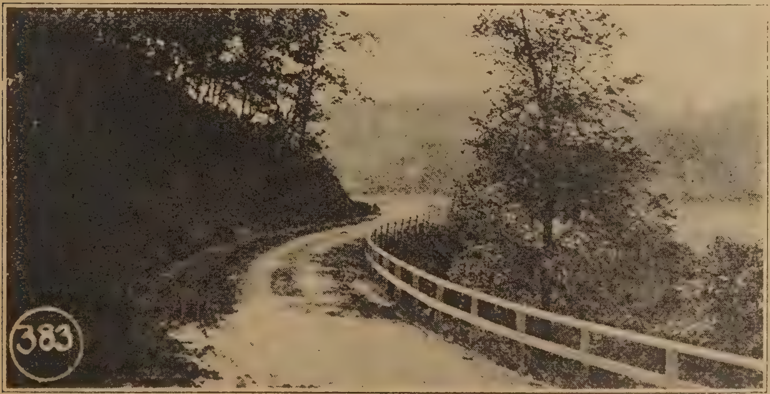


FIG. 3. A portion of the Beaver Hill relocation, Trunk Highway 28, between Spring Green and Plain, Sauk County. The old road had grades as steep as 22%. The maximum grade on the relocation is 7½%.

of way. The only case that may be excused is where a tree is an absolute obstruction to travel and might be considered a hazard.

Planting Shade Trees-Clearing Right of Way. Many communities are fast realizing the value of beautiful shade trees along the highways, and commissioners and patrolmen have been very active in planting trees where they do not exist at the present time. Grass, weeds, and brush should be cut and old logs, stumps, etc. should be removed or burned. The practice of piling small stones around sign posts and other poles along the highway and covering them with a coat of whitewash lends attractiveness to the highway.

Objectionable Signs. All objectionable signs and other features should be removed from the right of way, and the patrolman can do very much with the farmers along the highway by cooperating with them in keeping the roadside attractive at all times.

Parking Areas, Etc. Many cases exist throughout the state where slight relocations have been made at sharp turns or corners, and a triangular plat of ground has been left at the intersection of two or more highways. These small plats of ground can be made very attractive by keeping the grass cut and the trees trimmed. They make very desirable stopping places for tourists and motorists on hot summer days.

Camp Grounds. There are several hundred camp sites along the State and County Trunk Highways and much good work can be done by the patrolmen by occasionally visiting the grounds to see if sanitary conditions exist, and also to see that all rubbish and refuse is being removed properly, and wherever necessary, report to the proper authorities if this is not being done.

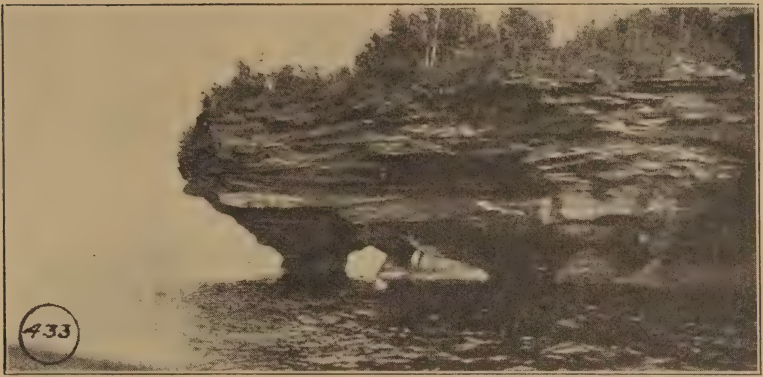


FIG. 1. Devil's Island, Lake Superior, Bayfield County. Near S. T. H. 13.

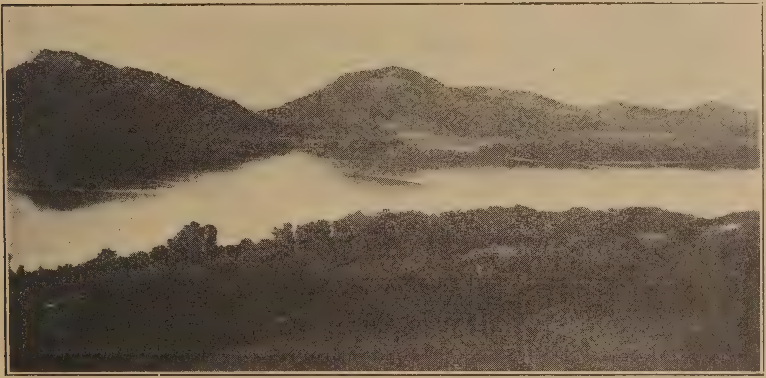


FIG. 2. Perrot Park, and Trempealeau Mountain. One of Wisconsin's beautiful state parks. Reached over No. 162. View across the Mississippi River from the Minnesota side.

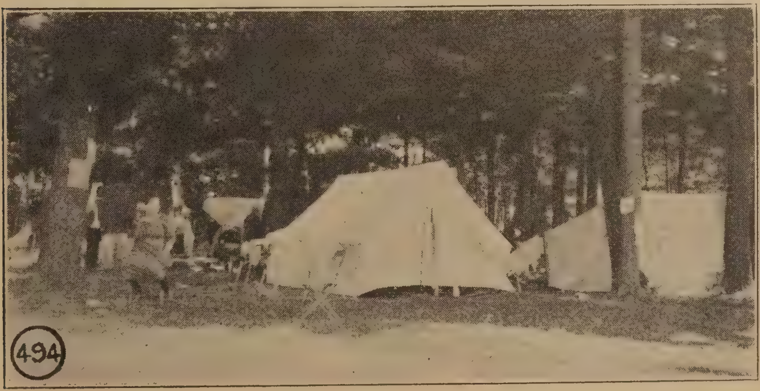


FIG. 3. A typical Wisconsin tourists' camp. More than 200 Wisconsin cities and villages have provided free tourists' camp sites.

FOREST FIRES

Such Fires on Forest, Marsh and Cutover land are destructive. They should be stopped. Road Patrolmen can help.

THE WISCONSIN LAWS SAY:

1. That the Conservation Commission has general charge of the fire protective forests of the state.
2. That special fire districts can be established and organized for protection against fire.
3. That all town chairmen and road superintendents are town fire wardens.
4. That all conservation wardens are fire wardens at large.
5. That all fire wardens have authority to order men and teams out to fight running fires.
6. That all able-bodied men who so ordered are required to go, under penalty of arrest.
7. That definite methods and rates of payment for fire fighters are authorized.
8. That a person or corporation is liable for the fires they set.
9. That camp fires must be extinguished.
10. That town chairmen can forbid the setting of fires during dangerous dry times, by the posting of special warning notices, and that during such times no one can set a fire until written permission is received from the town fire warden.
11. That locomotives must be equipped with serviceable spark-arresting devices, particularly when running through forest country.
12. That all fire wardens must render an annual report on fires to the State Conservation Commission as directed.

HIGHWAY OFFICIALS, PATROLMEN and ROAD WORKERS:

1. Many fires break out along highways.
2. All these fires should be stopped and put out before they travel any distance.
3. Every road worker and especially every patrolman is hereby instructed to drop everything and put out every fire starting or burning along a highway.
4. Every patrolman should carry a shovel and pail for such work.
5. Every patrolman should caution campers along the road; also settlers and users of the road generally, to be careful with fire at all times.
6. The utmost caution should always be used by the patrolman when burning rubbish and other debris on the highways.
7. Do your bit toward educating the public to the point where they will realize the seriousness of fires. Patrolmen and other highway workers should set the example for others to follow.

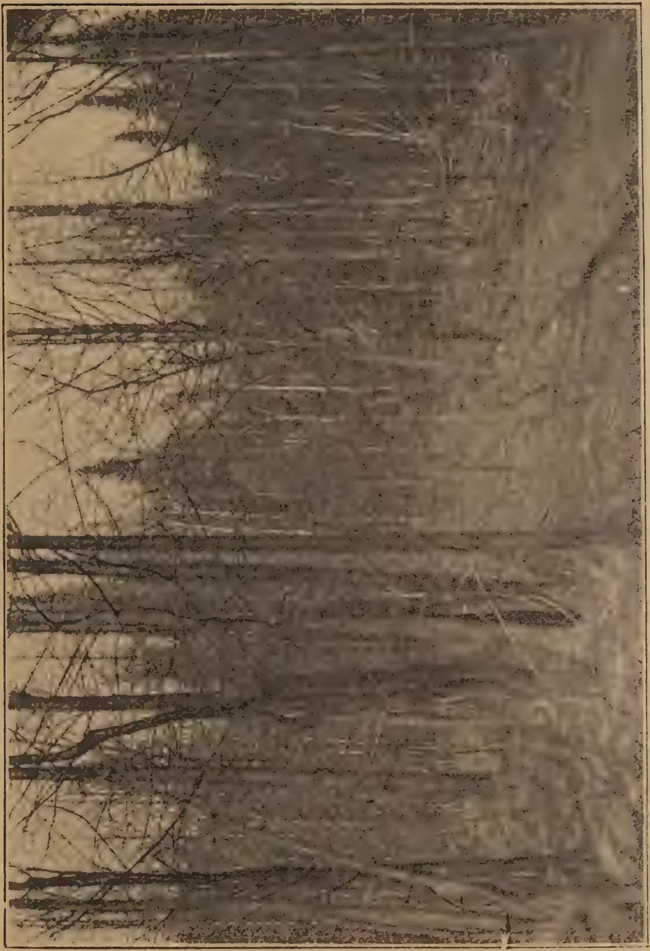


FIG. 1. 15 minutes of fire destroys 15 years of growth.

THE PROPOSITION

No one wants to see the country burn up. In spite of this, when the weather conditions are right we all know that fires are not uncommon. We all know that they are unnecessary and destructive. A distinction ought to be made, however, between a beneficial fire and a destructive fire. If a man is clearing up a few acres, he must use fire to do a good job. If a camper wants a cup of coffee he often builds a camp fire for such purposes. Railroads are required by law to clean up and burn over their rights of way yearly. These are examples of beneficial uses of fire and it would be unreasonable to restrict such a use. Fire is an important force in developing and cleaning up the country, but when any of these fires set for a beneficial purpose are allowed to get away and burn over thousands of acres, they become harmful and destructive. Such broadcast fires have devestated thousands of acres of land in Wisconsin. These lands should all be growing a thrifty volunteer crop of second growth timber that would be from 4 to 10 inches in diameter on the stump now. We get no trees, no game, no water, no natural beauty in fact nothing from fire swept areas. Such uncontrolled fires do no good whatever. They are totally destructive and should be stopped.

Fires and Highways. Before the advent of the wide graded highways there was little in the cut-over country to stop the sweep of fires. The present county and state trunk highways are the best of fire breaks. Where they run parallel to railroad lines these highways reduce the possibilities of fires from railroads just one-half. The motorist, however, has been responsible for starting many fires. He often is a camper. He generally is a smoker. The result, as we all know, is that fires often break out along the roads. The causes are many but when they start they are always small and at this point the patrolman can be of great help. He gets over his patrol section frequently and he should never pass a fire on or near the road without putting it out completely. Fire suppression is a part of road maintenance. Oftentimes a patrolman is maintaining his section burns the debris on the right-of-way himself. He should never let his fire get beyond control. On numerous occasions patrolmen have let their fire get away. To avoid this he should pick out a good day for such burning so that the fire can be controlled easily. On a dry or windy day he should watch it with extreme care. A patrolman who thinks anything of his job should never permit a fire set by himself or started carelessly by others to burn along his section without extinguishing same. The best tools to carry for such purposes are a shovel and a pail. The shovel is especially useful in a sandy country for the soil is easy digging and in a short time a fire can be sanded and beaten out. Water is oftentimes handy and the pail can be used in such cases to good advantage. If a fire gets too large so that one man cannot attack it successfully, the patrolman should call up the nearest town chairman or state fire warden and tell him of the circumstances. Every patrolman should consider the protection of the country on and adjacent to the highway he patrols as a part of his maintenance job.

What the State is Trying to do. The state is making a special effort to prevent all uncontrolled fires and to suppress fires quickly after they start. To do so the state must have the assistance of all citizens in the regions in which the risk from fires is pronounced and especially of public officials and workers. The legislature of 1923 authorized the establishment of special forest protection districts. The legislature of 1925 amplified and broadened this law. Under it thirteen forest protection districts have been laid out. The limits of six of these have been published and they are being organized as rapidly as possible. The idea is that suitably sized areas in which there is a material risk from fire will be set aside to constitute a unit for protection purposes—that all land outside of incorporate units of government and irrespective of ownership, whether cut-over or forested—will be protected and that this effort will continue year in and year out. There may be cases, of course, where special emphasis will be laid on some particular area because of special circumstances, but essentially the lookout installation, patrols and other considerations will be by the district as a whole rather than by any portion of it. A district forest warden will be put in charge of the work in each district. The headquarters for the districts established have been located at Brule, Gordon, Trout Lake, Crandon, Dunbar and Park Falls respectively. At each one of these district headquarters a district fire warden is in charge during the fire season from April 1st to December 1st. The salary and expense of the district fire warden, as well as of equipment and other kinds of property needed in this undertaking, will be owned by the state with the assistance of the federal government. Lookout towers will be established at commanding points, lines of communication between them constructed and the assistance of all interested agencies sought in this work of preventing and suppressing fires. During times of droughts and emergencies a special force of emergency fire wardens will be needed. Plans are made so that this emergency field force may come into action as occasion demands and that this field force may expand as the risk increases and shrink as the risk decreases. All details relating to the work in each special fire district will be handled in conjunction with the county boards acting directly or through a special conservation committee.

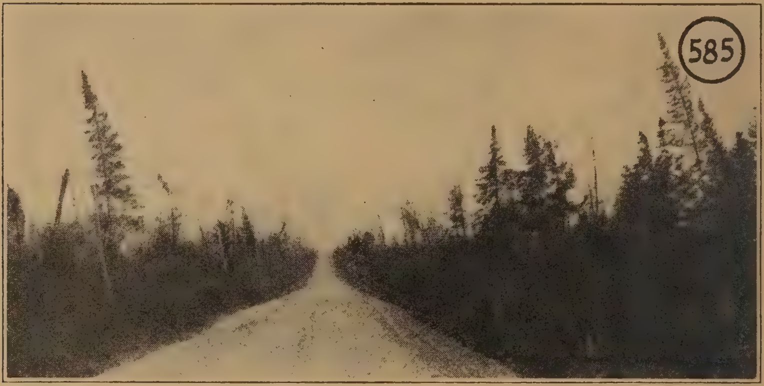


FIG. 3. State Trunk Highway 32 showing where forest fire devastated a large area in Langlade, Forest and Oconto Counties.

Fire Protection a Part of Road Maintenance. The protection of the country on and adjacent to state and county trunk highways should undoubtedly be considered a part of the highway maintenance for travelers are not only interested in the grade and physical condition of the road itself but they are likewise interested in the condition of the country through which the road passes. All resources, whether a farm or forest adjacent to highways, should receive protection for it should not be overlooked that these resources contribute materially not only to the initial cost but to the maintenance of the highways themselves. Every patrolman should be instructed and should continually exercise an interest in protecting the resources of a region from any destructive agency and one of the chief of these destructive forces is fire.

CHAPTER VI

EQUIPMENT

Necessary Equipment, Shop. To successfully carry out the maintenance work, the county must be properly equipped with efficient machinery and possess the necessary facilities for keeping it in repair. There is no county in the state but what has or should have enough equipment to justify a central repair shop. It is true that all equipment cannot be moved to the shop for minor repairs, but overhauling and extensive repairs can be made in such a shop at a considerable saving to the county. The shop must be in charge of a first-class all-round mechanic, who is practical and a good organizer. Minor repairs which become necessary from day to day out on the job can usually be taken care of by someone in the crew or by the patrolman, in case it is his equipment. It often happens that repair work may be taken care of at local shops. If necessary, the shop foreman or one of his assistants can come out to the job on short notice. It is quite essential that every foreman and patrolman be able to make minor repairs.

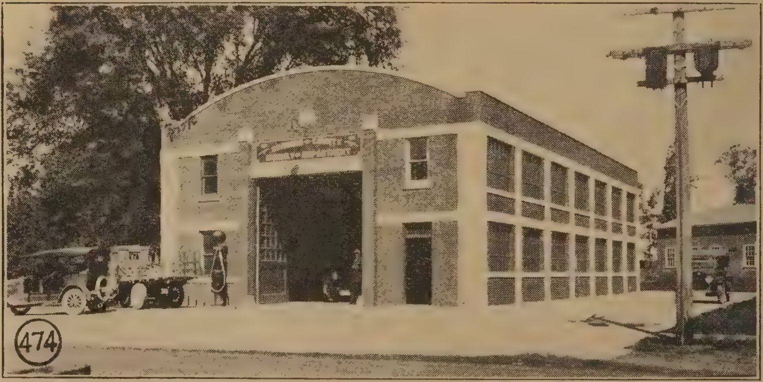


FIG. 1. Shawano County garage and shop. A fine building, well equipped. This county has adequate facilities for keeping its machinery in efficient condition.

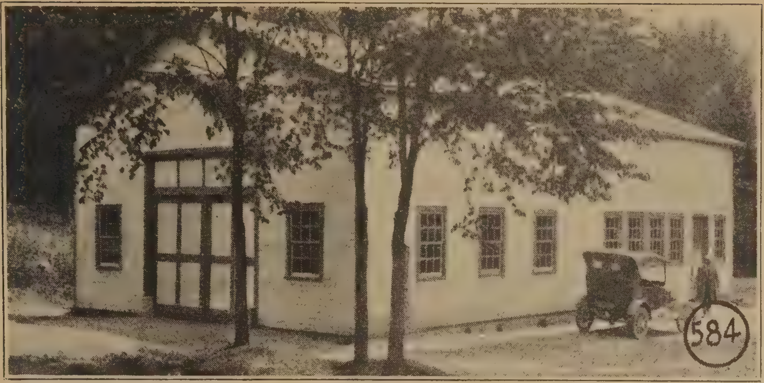


FIG. 1. Wisconsin Highway Commission Shop and Storage shed at Keshena Falls, Menomonie Indian reservation.

The central shop may be an economical or an expensive proposition, depending on how the foreman handles it. It is not wise to transfer machinery long distances for slight repairs, but it must be kept in mind that all tools and machinery should be in a good state of repair at all times in order to turn out efficient results. Some counties have tried to "limp" along with old worn-out machinery, which in all cases is a very costly practice. On the other hand, some commissioners have a mania for purchasing every new machine or tool on the market. Whether they need it or not. they will find a place for it on the job. There is a happy middle course that should be pursued.

Standard Equipment. In the case of a team grader section, the patrolman should be supplied with a patrol grader which will stand the strain of four horses pulling it on ditch work too heavy for two horses, and which will weigh from 1200 to 1600 pounds. He should also have a road planer, slip scraper, road plow, stone boat, chain tool box, axe, bar, pick and shovel, and other necessary small tools. The road drag is practically extinct on State Trunk Highways inasmuch as the work performed by them does not meet with present day traffic requirements. The drag in early days, and even today on the secondary roads, is used primarily to move surface soil or metal so that it may dry out. Experience has shown that in order to get a uniformly even surface, an implement having a longer span than a drag must be used. This has led to the use of the road planer and the road grader, and various other machines used in maintenance work.

Maintenance Grader or Machine. One of the principal requirements of any maintenance machine is that it has at least a 9 or 10 foot wheel base, and in most cases a longer wheel base is advisable. The small team grader has probably been the most important machine in the maintenance of the State and County Trunk Highways. It will continue to be an important piece of equipment. However, it is advisable on many sections to motorize in order to keep the maintenance work up to the requirements of traffic conditions. A patrol grader should fulfill the following requirements:

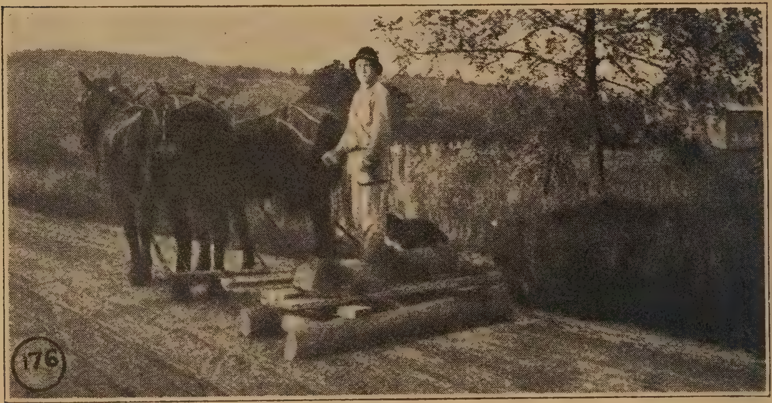


FIG. 1. Primitive maintenance methods. The split log drag had its day when the horse or, ox drawn vehicle reigned supreme on the highway.

1. Wheel base should be at least 9 feet.
2. Front wheels should be not less than 24 inches in diameter, rear wheels not less than 30 inches. Flanges not required.
3. Wheels should be so constructed that grease can easily be forced over the entire length of skein without removing the wheel.
4. Blade not less than 8 feet and hung equidistant between front and rear axle.
5. A positive raising and lowering device. Blade must stay where placed without the patrolman being compelled to hold the raising or lowering wheel or lever in the desired position.
6. Should have a roomy tool box securely fastened to frame.
7. Weight should be from 1200 to 1600 pounds.
8. Rubber tires are advisable.

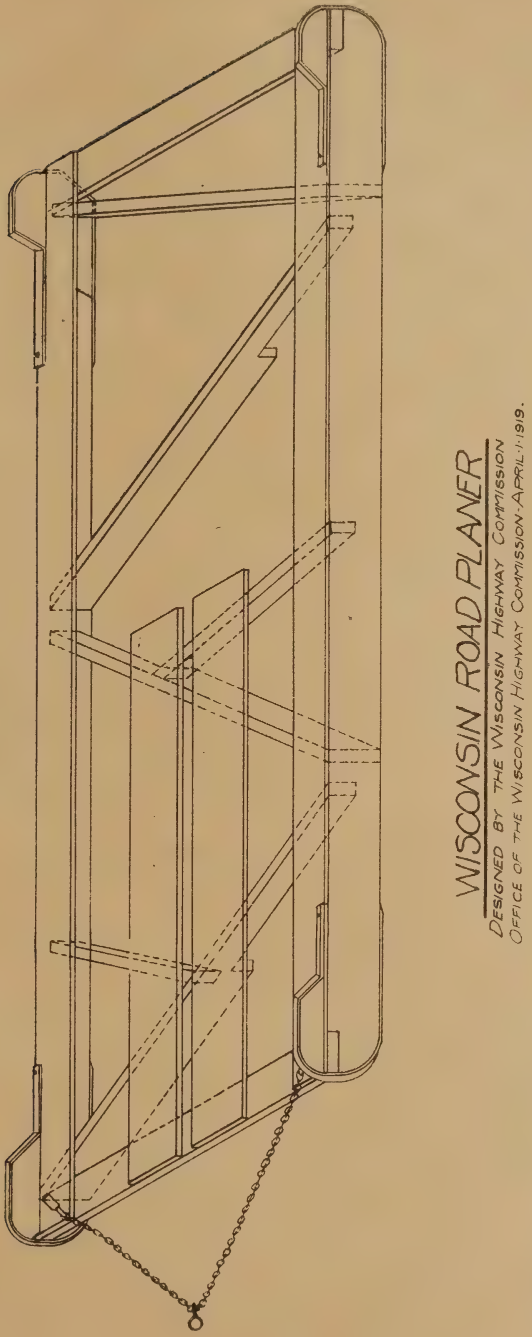

WISCONSIN ROAD PLANER
DESIGNED BY THE WISCONSIN HIGHWAY COMMISSION
OFFICE OF THE WISCONSIN HIGHWAY COMMISSION·APRIL·1·1919.

FIG. 1. This type planer will do good work where traffic is fairly light. For heavy traffic a much heavier planer is desirable.

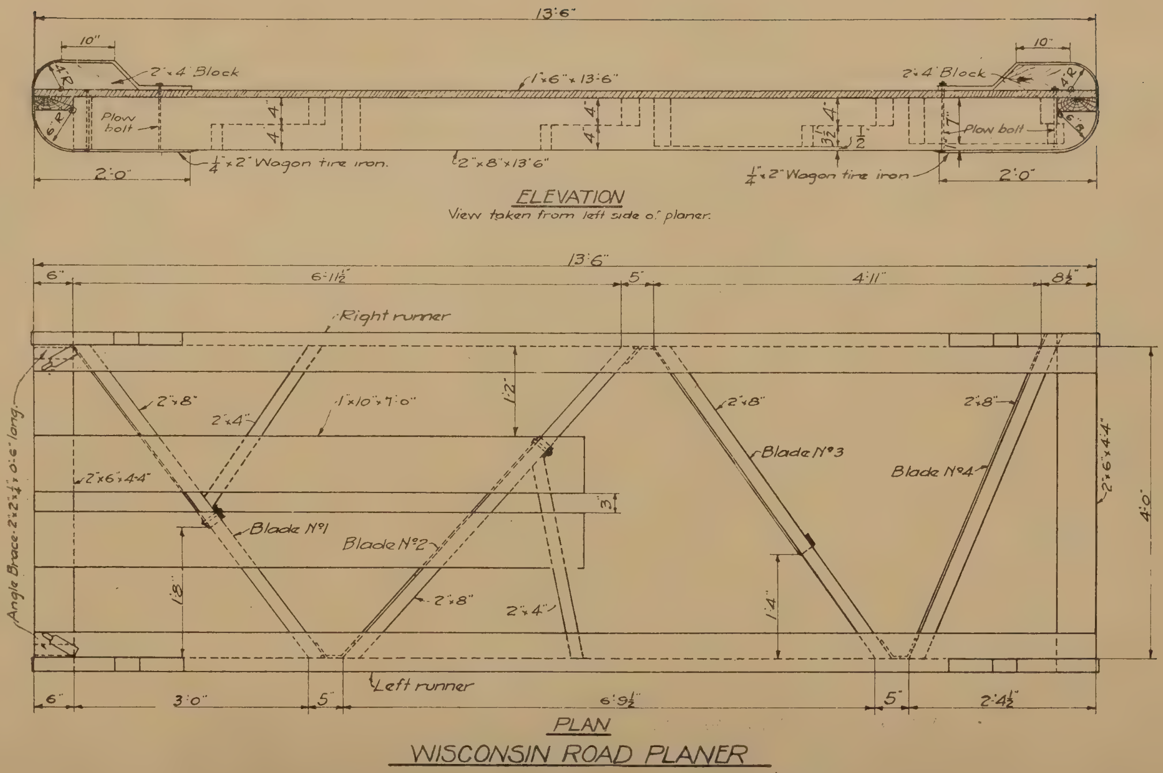


FIG. 1. Plan of the Wisconsin Road Planer.

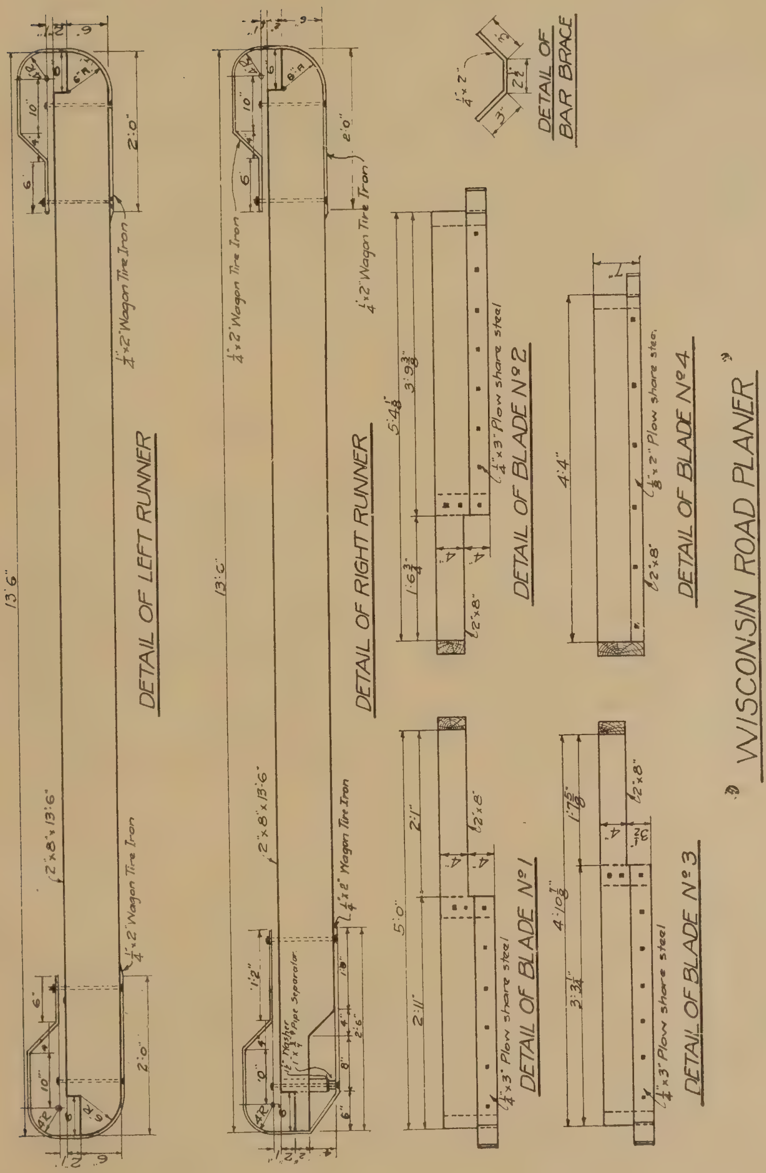


FIG. 1. Details of Wisconsin Road Planer.

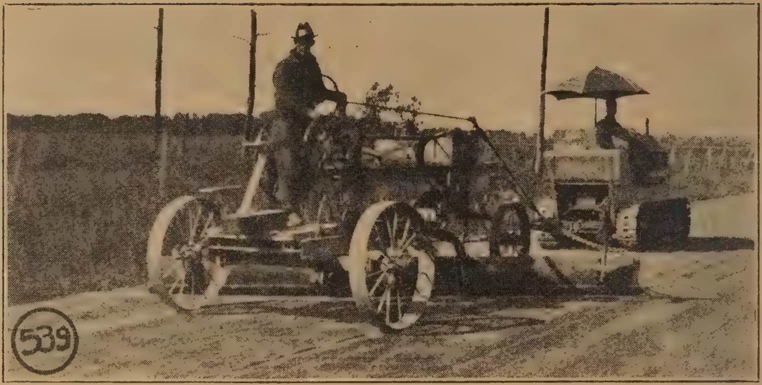


FIG. 1. A grader with blade of double width, pulled by a tractor. S. T. H. 26 Langlade Co.

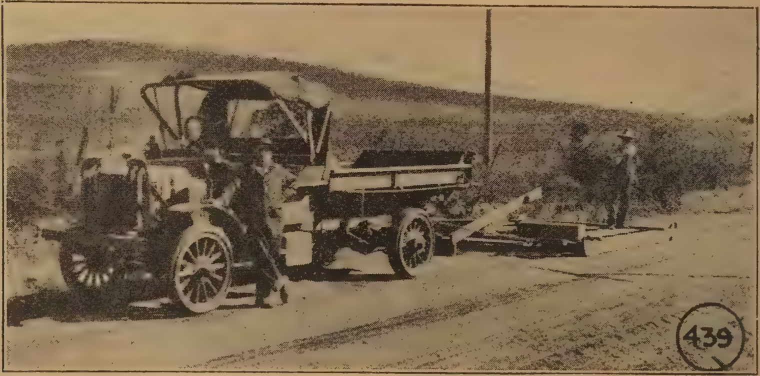


FIG. 2. Truck Pulling two Wisconsin Planners, S. T. H. 12, Dane County.

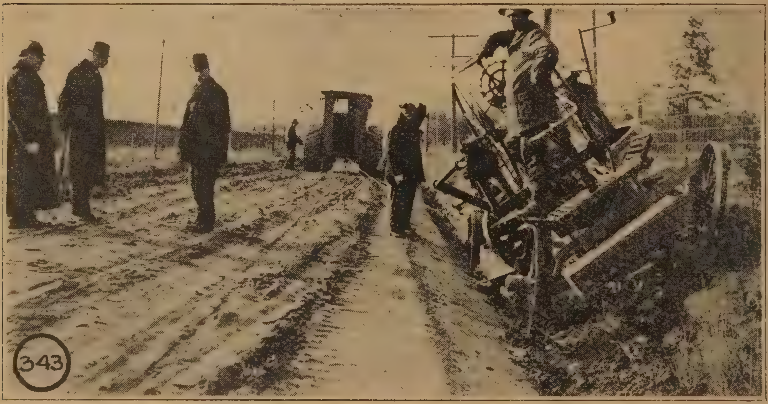


FIG. 3. Doing Gang Maintenance work with a heavy outfit.

Road Planer. The road planer is especially helpful in the maintenance of gravel and light surfaced roads. The proper time to use the planer is during dry spells when very effective work can be done. The ordinary road planer is not sufficiently heavy to do any cutting, as it is designed primarily to plane surfaces. When cutting of high places is necessary, this work can be done more easily and cheaper with a road grader.

Motorized Equipment, Advantages. Where traffic conditions warrant, the equipment should be motorized in order that the section may be covered more often than could be done with a team. The average team will travel about 15 to 18 miles per day, where a power grader will travel 30 to 40 miles. This is a very important factor after rains and wet spells. It must be remembered that the one-man motor grader is primarily a road surface machine and that teams will occasionally be required to supplement the work of the motor grader.

Types Used. The following combinations have been used with success in various sections of the state: (1), a truck pulling grader or one or two planers; (2), a one-man power grader; (3), tractor pulling two graders or planers; (4), blade attachments that may be placed on all standard trucks.

Each combination seems to have its advantages in certain parts of the state, or on certain types of road. Some commissioners favor one type, while some favor another. All the above outfits will do good work but the most economical results will be obtained with the one-man machine. Where a truck or tractor and two graders are used, the services of at least three men are required and this naturally will run up the maintenance costs. One thing seems to be prevalent, however, on all motorized equipment, and that is that there seems to be a tendency to develop drivers rather than patrolmen. It must be kept in mind that the primary object sought is to give a well maintained road surface, and that, while the mechanical operation of the equipment is very essential, the results obtained on the road are still more important.

Heavy Outfit. Every county should own and operate at least one big grading outfit. By this is meant a large tractor

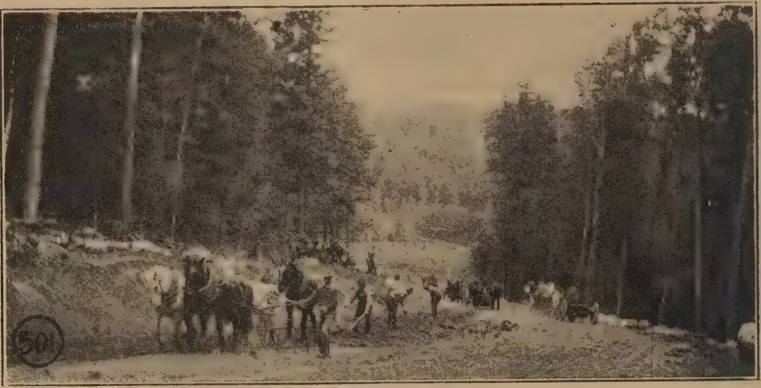


FIG. 1. Heavy grading with teams. Work on a relocated highway in Northern Wisconsin. Forest County.

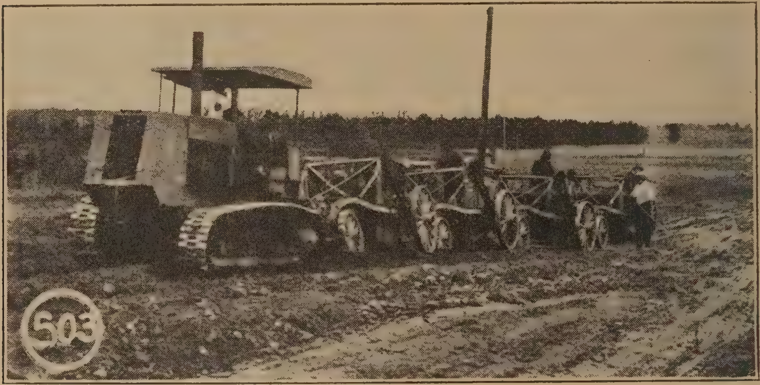


FIG. 2. Grading with power machinery. A caterpillar tractor working four Maney grades in a train. Formerly tractors used mostly in place of a snatch team. Now teams are often dispensed with altogether.

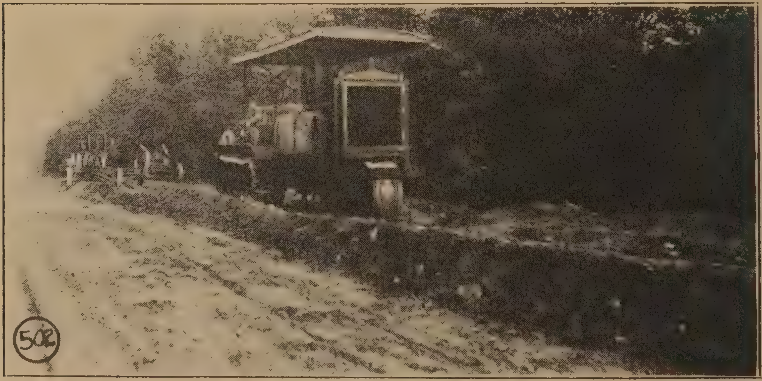


FIG. 3. Blade grader work on a large scale. A 20-ton caterpillar tractor is pulling two 12-foot blade graders. This type of machinery, with skiled operators, can construct serviceable roads at very low costs. Polk County.

of ten or more tons, of the big wheel or track laying type, and a large, heavy grader with at least a 12-foot blade. This outfit should be used in opening up the ditches and for grader work where heavy cuts and fills are not necessary.

Other Equipment. Other equipment necessary for the successful performance of all types of maintenance work are as follows: Complete portable crushing plant with bins and loaders; trucks for hauling; wheelers; slip scrapers; fresnos; dump wagons; and small tools such as shovels, picks, barrows, etc.

Many of the equipment manufacturing companies are putting good machines on the market, while some are manufacturing machines that are very unsatisfactory. County commissioners and road builders should thoroughly investigate all types before purchasing and make sure that when the equipment is put to test it will perform properly and produce results in their particular county. Performance and not price should be the governing factor in the purchase of all equipment. It often happens that the cheaper machine in initial expenditure is the more costly in the end. Therefore, do not always buy the machine that is cheaper in first cost but carefully consider all local factors, such as soil, topography, type of work, operator, and expected results, and you will be better able to choose the equipment that fits the conditions in your locality.

Machinery Rental. The commission will allow a reasonable charge for use of county machinery on maintenance work, and will honor requisitions carrying machinery rental charges provided an agreement has been entered into at the beginning of season. A copy of the signed agreement on standard form must be on file at the main office of the Highway Commission before any machinery rentals will be allowed.

CHAPTER VII

MAINTENANCE OF EARTH ROADS

Effect of Systematic Maintenance. The systematic maintenance of any road or system of roads has a very beneficial effect on rural life. It enhances land values, betters marketing conditions, improves the social life, extends the advantages of the city, broadens the educational field, and has a stabilizing influence in general. As may be noted from figures in the forepart of this bulletin, the great bulk of rural highway mileage in this state is earth roads. Figures show that about two-thirds of the entire mileage is comprised mainly of earth roads partially improved, a good many of them very slightly improved. The time is not far distant when both the state and the county trunk highway systems will be practically surfaced with some type of surfacing. A good share of the town or local roads will be surfaced with light surfacings, but it will be many years before a large mileage of local or town roads will be improved with surfacing. For this reason the maintenance of this type of road is quite important, especially from the viewpoint of the farmer.

Classification of Earth Roads. Earth roads may be divided into four general classes, as follows:

(1) Sandy soils
(2) Light clay soils
(3) Heavy clay soils
(4) Natural Road soil which is a combination of sand or gravel with clay.

SANDY SOILS

Method. Very little can be done to an extremely sandy road with a grader or planer. The best treatment for a sandy road is to add clay or top soil and create a crust or surface shell that will shed the water and provide a smooth

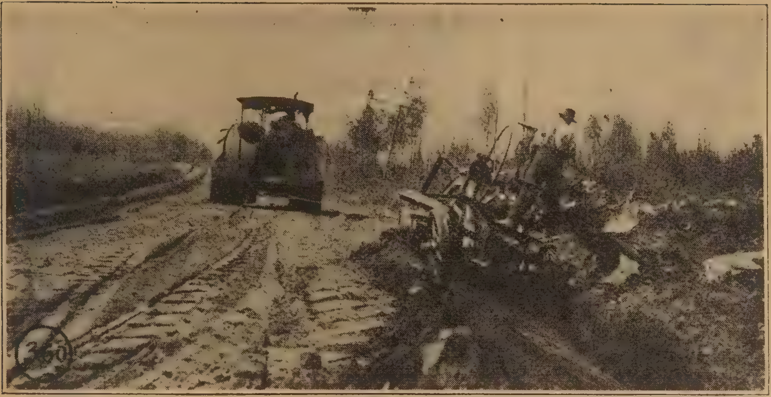


FIG. 1. Gang maintenance in Oneida County. A 40 to 60 horse power tractor is used for power, pulling a heavy 12-ft. blade grader.

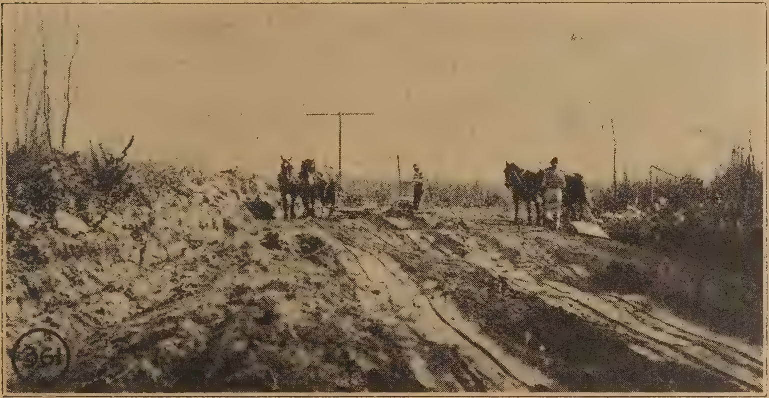


FIG. 2. The manner in which the surplus dirt at the high places is moved to the low places, following the tractor and grader. Fresnos may be used to good advantage on tis class of work.

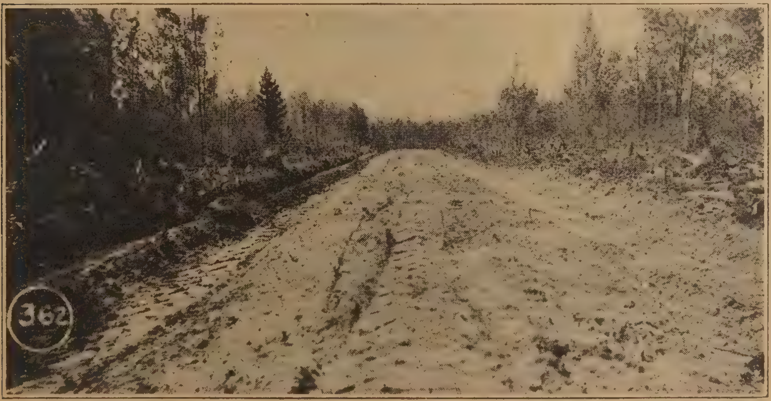


FIG. 3. A view of the same road as Fig. 1. Note the straight, clean-cut ditch line. This road is nearing completion.

surface for travel. The method to pursue is essentially as follows:

Clay on Sand. Work the loose sand out from the center of the road toward the shoulders, taking care that a flat subgrade is procured and clay then applied to a depth not to exceed three inches in a single application.

Spreading and Mixing. This is spread evenly over the surface of the sand, and with the use of a peg-tooth harrow or a similar device it is thoroughly mixed and all lumps pulverized. Then with the use of a disc harrow, farm cultivator, or a similar device, the clay is thoroughly mixed with the top four or six inches of sand. In this process a thorough and uniform mixture of the sand and clay should be secured.

Proper Amount of Clay. The object is to use sufficient clay to fill the voids in the sand and no more, and to mix the materials so thoroughly that there will not be any lumps of clay or pockets of loose sand. Too much clay will cause the surface to become slippery and rutted in wet weather and too much sand will cause it to become loose and mealy in dry weather, either of which is undesirable. Not all clays will satisfactorily bind with sand. There seems to be a great variation in the quality of clays throughout the state. A simple test of quality may be made in the following manner:

Testing Clay. Take a handful of clay, wet it sufficiently to make it plastic, and work it into a well compacted ball. Place the ball on a board or on top of a fence and allow it to thoroughly dry out. After the ball has become hard and dry, immerse it in water. If it dissolves quickly, you may be sure that it does not contain the proper bonding qualities. However, if it retains its shape in the water but disintegrates slowly, the clay may be considered suitable. It must be borne in mind that it is not always possible to get the desired quality of clay due to the fact that it must be hauled, in many cases, for long distances. This, of course would not be economical and may warrant the use of inferior clay.

Use of Grader or Planer. After a thorough mixture of the clay and sand has been effected, a grader or planer should be used to fill the depressions and cut down the high spots to form a uniformly smooth surface. Should the surface become loose or mealy during dry weather, more clay should be added, and if ruts and mudholes appear after rainy weather, more sand should be added. To get the desired results will require careful observation and constant maintenance. After a patrolman has worked with this type of road a short time he becomes accustomed to the various mixtures required and before long can properly adjust the soils to get a desirable wearing surface. Many miles of this type of road have been built through maintenance operations in the state. For light traffic it gives a very good surface, and also may be used as a base for gravel or other surfacings at some later date.

Use of Bark, Shavings, Marsh Hay, Straw. In quite a number of counties sandy spots in a road have been temporarily taken care of by placing bark, shavings, marsh hay and similar materials. These, of course, are just temporary and will not last for any length of time. It is well, however, for the patrolmen to know that such materials may be employed to temporarily take care of traffic when conditions demand.

Use of Bitumens. It is believed that a suitable surface can be procured by a mixture of sand and bitumen. Some experiments have been tried along this line and the Commission expects to experiment further in a hope to find another solution of the sandy road problem.

CLAY SOILS

Characteristics. There are certain sections in the state where heavy clay soils predominate and where surfacing materials are rather scarce. A clay road during dry weather, outside of being dusty, gives a very satisfactory surface to drive over. However, in wet weather it gives considerable trouble to traffic. It becomes very slippery and ruts and mudholes form, thus requiring constant work on the part of the patrolman to keep the surface uniform and smooth. Where gravel and crushed stone are not available and sand may be found, this may be used with quite satisfactory results.

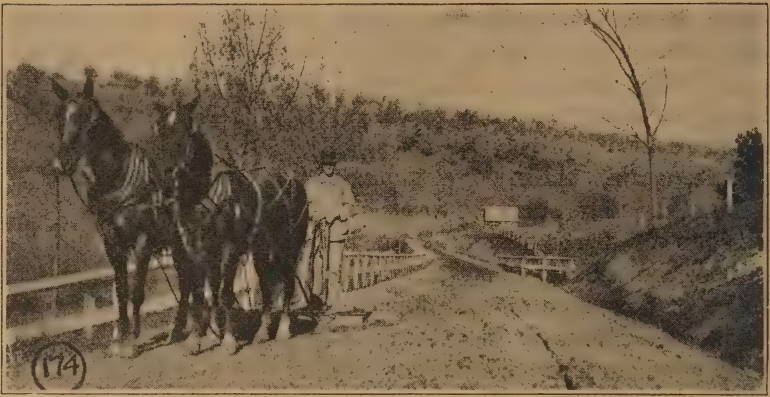


FIG. 1. Pauls Hill, Richland county, gettig the first spring dragging by the patrolman. Note the rut near the center of the road.

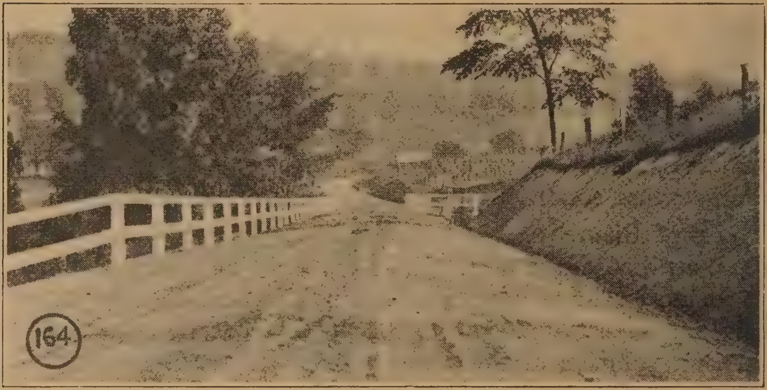


FIG. 2. The same road after having been properly dragged, the ditches cleaned out, and the bank slopes properly taken care of.

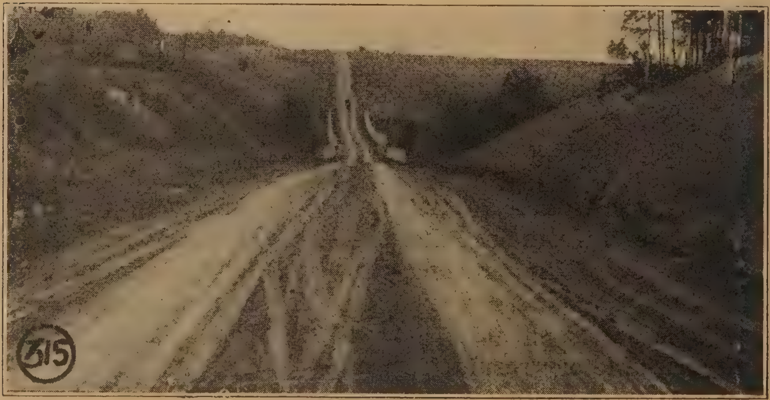


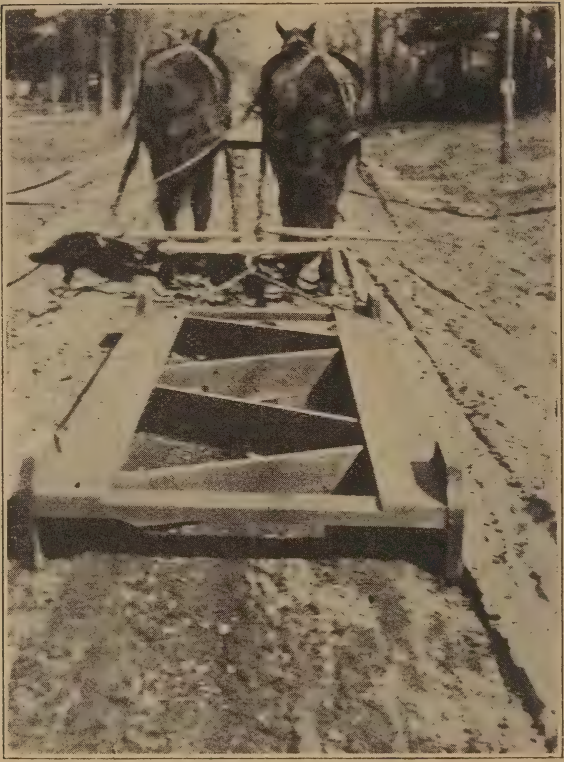
FIG. 3. Red Clay Road, Douglas County, east of Iron River.

Sand on Clay, Spreading and Mixing. The traveled section of the clay road is scarified to a depth of two or three inches and the material pulverized with a disc harrow or some similar device before applying the sand. Sand is then applied to a depth of four to five inches and thoroughly mixed with the clay by the use of a harrow or cultivator. The surface is then shaped to a uniform cross section with a blade grader. The idea is to get a uniform mixture of sand and clay in the same manner as described under Sandy Soils. Excellent results have been secured by applying six or eight inches of coarse sand at one time and permitting travel to force the clay up through the sand during rainy weather. When this method is employed the best results are obtained by applying the sand late in the fall or in the early spring.

Use of Grader or Planer. By continuous use of the grader or planer or either of the above methods, mixtures of sand and clay will give a fairly adequate surface at a minimum cost. Where a plain clay surface is being maintained, care must be taken not to fill the ruts formed after rainy weather with wet spongy material. They may be filled with dry earth or sand or gravel but in any event the clay should be allowed to dry out. Patrolmen often feel that they cannot do any grading or planing on a clay road until it is dried out. In order to get the best results the patrolman should get out when the surface is really too wet and he will find that by the time he has completely covered his section the surface has become very dry and hard, and if he were to wait until the entire surface had dried out it would be practically impossible to get a smooth surface.

NATURAL ROAD SOILS

Sand and Clay Mixtures. In quite a number of counties in the northern part of the state the soil seems to be a natural combination of sand and clay or, in some cases, fine gravel and clay. This gives a very satisfactory road to build and maintain for light traffic. Many of the roads in the northern part of the state that consist of this material will be adequate for quite a number of years under the



The above is a view of the Wisconsin Road Planer at work. This planer is a combination of the good features of several types of planers now in use.

It is designed to fill ruts, actually planing the surface between the runners, leaving the material exactly where it was prior to the rain. It will neither add nor remove crown. This is work that can be done cheaper and better with a light blade grader. The high spots are cut off by the two first or cutting blades and moved back and forth between the runners a sufficient number of times to insure filling all ruts, holes, or depressions. The third blade is so placed that the lower or cutting edge is one-half inch above the bottom edge of the runners. This permits a portion of any surplus material to pass out under the blade, thereby getting away from loading up. The fourth or leveling blade has no opening but is so placed that the bottom edge is one inch above the bottom of the runners and allows all surplus material to pass under the blade. An apening in the runner immediately ahead of the end of the fourth blade nearest the end of the planer, permits any stone or gravel loosened by the cutting blades to be discharged. No earth passes out through this opening.

The first and second blades should be set flush with the iron shoe of the runners.

regular patrol method. New material must be brought in from the ditches and the sides frequently as the old becomes worn and loses its binding qualities.

In order to keep an earth road smooth, whether it be a combination of sand on clay or clay on sand, or natural soils, the surface should be graded from one shoulder across the road to the other shoulder. The patrolman should start with his blades set at an angle of approximately thirty degrees and move the material toward the center of the road, and when reaching the other end of his section he should reverse the blade and continue the operation toward the other shoulder, depositing the excess material on the opposite shoulder. At his next grading operation he should begin at the shoulder where he left off and repeat the methed outlined above. This will assure keeping the surface uniformly smooth and all depressions filled and high places cut down. *He should always remember however that, after rains he should blade the center of the road first.*

The matter of drainage, side ditches, outlet ditches, culverts, drain tiles, etc. is discussed under Chapter V. The principles outlined there apply to this type of road. The matter of erosion, shoulder maintenance, cutting of grass, weeds, brush, etc., slips and slides, frost holes, roadside beautification are also covered in Chapter V.

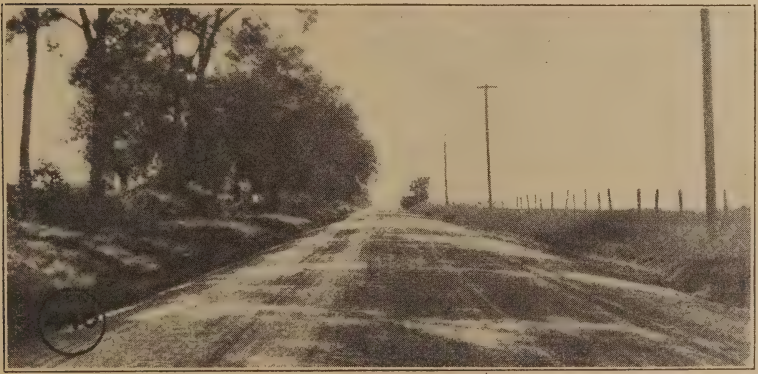


FIG. 3. Earth Road, S. T. H. 19, Iowa County.

CHAPTER VIII

MAINTENANCE OF GRAVEL, SHALE, MINE TAILING AND DISINTEGRATED GRANITE ROADS

Natural Deposits. Wisconsin is quite well supplied with gravel deposits in various sections of the state. There are a few localities where it is very scarce but generally speaking this type of material is very commonly used. Deposits of shale and disintegrated granite occur in certain counties, while mine tailings are to be found in the region of the lead and zinc mines in the southwestern part of the state. All of these materials are satisfactory for surfacing purposes. Gravel, of course, will probably wear longer than any of the other materials.

Shale. Shale deposits occur in the western and southwestern counties. It varies in quality from the brittle sandstone with very little binder to the compound having a large amount of clay binder. Experience has shown that the deposits having a moderate amount of clay present make the most statisfactory surface. In many of the counties where gravel is very scarce, nature seems to have left shale deposits, thus making it possible for these counties to have some surfacing material.

Shale roads are built substantially in the same manner as crushed stone and gravel roads with the exception that shale is not put through a crusher, however, the material binds much more readily and forms a very densely compacted surface. When shale surfacing is dry very little grading or planing can be done on it. The time to fill depressions and cut down uneven spots is immediately after a rain, or during the spring when frost is coming out of the ground. If there is too much binder present in the shale, it is apt to get slippery during rains and it is advisable to put on a light surfacing of coarse sand or pea gravel. During dry weather shale surfacing is practically as hard as a pavement and is very satisfactory if the depressions have been filled and the high spots cut down, but it is apt to get dusty from the small particles that wear off under traffic. In many localities where gravel is scarce and shale is available, shale is used for a base course and is quite satisfactory for this purpose. For the top course gravel is used and this combination makes a very good road.

Disintegrated Granite. Deposits of this material which makes a good temporary surfacing are quite numerous in the north central part of the state. It consists mainly of broken-up particles of granite. There is a wide variation in this material from the hard, which is practically all metal, to the soft, which contains a large amount of clay and other materials. The maintenance methods to be employed on this type of surfacing are similar to those discussed under shale roads except that when depressions occur more material must be added and in all cases there should be stock piles scattered along the highway.

Mine Tailings. Mine tailings are used quite extensively in the southwestern part of the state where there are quite a number of lead and zinc mines. This material is the waste from the ores mined in this locality. When placed on the road it looks very much like a finely crushed limestone, and while it does not wear as well as crushed stone or gravel, it makes a very satisfactory surface for traffic. New materials must be added from time to time to keep up the original depth of surfacing as it wears rapidly under heavy traffic. Care must be exercised not to draw in too much clay in the grading and patrolling operations.

GRAVEL

Abundance of. As stated in a previous paragraph, gravel is the most abundant road surfacing material to be found in Wisconsin and as a consequence, there are more miles of road surfaced with gravel than with all other types combined. This type of surfacing must take care of traffic on many of our main highways until a more suitable surface may be built, and in many cases it will be the main surfacing for several years to come.

Classification. Gravel roads in Wisconsin might be divided into two classes, namely, those roads which have

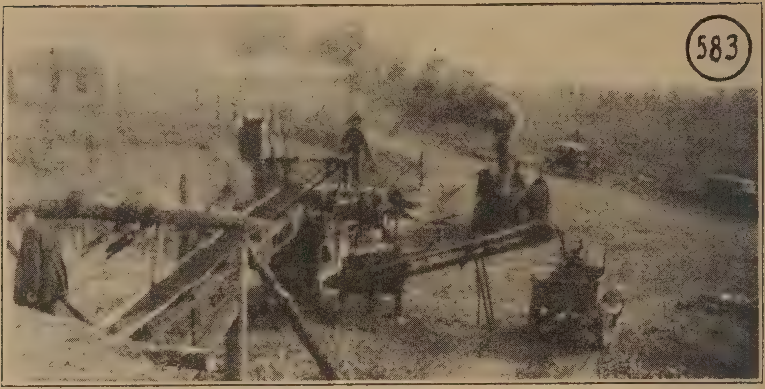


FIG. 1. A portable gravel producing plant in Iron County.

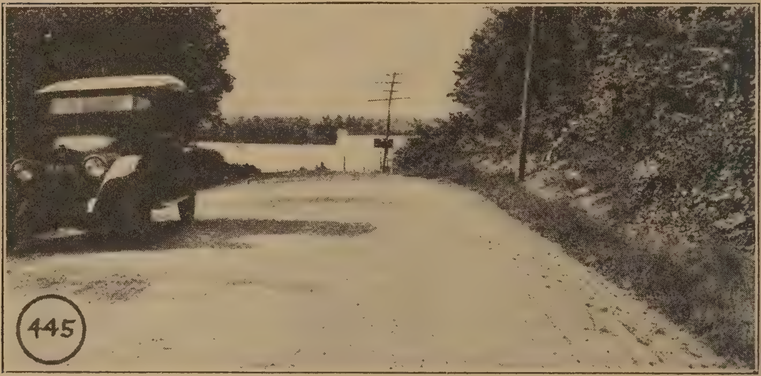


FIG. 2. S. T. H. 10, Oneida County, Lake Minocqua in background.

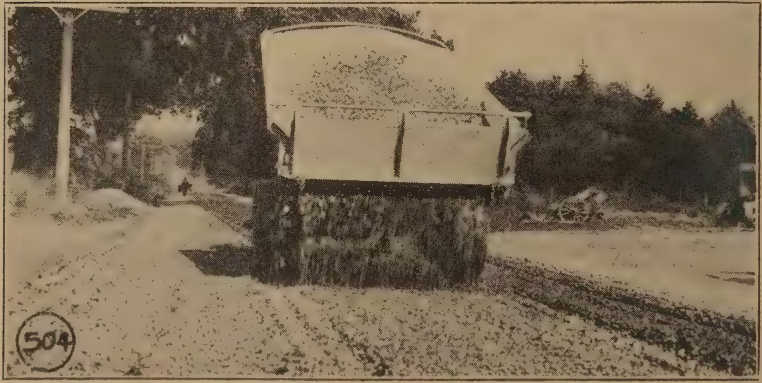


FIG. 3. Gravel road construction, spreading gravel. The truck operators become so skillful that the gravel requires scarcely any moving after being dumped.

been built according to specifications with proper depth and width and proper gradation of materials, and those which have been built through maintenance operations in several light layers. The latter class usually is not of full depth and may be called light surfacing. It will take care of moderate traffic while the first class mentioned will take care of fairly heavy traffic very adequately.

Pit Run Gravels. In the early days of highway construction a good many gravel roads were built of material taken just as it occurred in the pit, but experience has shown that it is almost impossible for a patrolman to keep a uniform cross section with pit run gravel or to maintain this type of surfacing economically. During the past four or five years practically all of the old pit run gravel roads have been rebuilt by scarifying and resurfacing.

Standard Specifications. The Wisconsin specifications now require that all materials in one course gravel roads must pass through a one inch round opening. This provides a material that may be readily graded or planed by the patrolman. Where a two course road is built, the bottom course shall consist of a mixture of gravel, sand and clay, all of which must pass a two inch screen, the top course to consist of the same material as used in the one course road. The one course road is usually built on the lighter soils whereas the two course road is more satisfactory where heavy soils are encountered.

Construction Features. In order to properly maintain a gravel road, the patrolman must have a working knowledge of the construction features as proper maintenance really consists of building up or adding materials from time to time. Practically all gravel roads built today have the maximum depth at center and are feathered at the edges, and the surfacing is spread in many cases over the entire width of roadbed. This provides a wide space for traffic to use and the concentration is, therefore, minimized, resulting in more economical maintenance.

Placing, Mixing, Grading. Before applying gravel, the subgrade must be graded to a flat cross section, and in many cases it is advisable to have it slightly concave. The surfacing should then be placed, preferably in thin layers of not to exceed four or five inches. Where it is dumped on the subgrade in loads, it should be immediately spread and a grader should be employed to constantly move the material from one side of the road to the other, thus making a uniform surface. *The most important period in the construction of a gravel road is during the actual depositing of the material and the time during which the gravel is "setting-up" or compacting.* A uniform surface is dependent on the care and attention given the material during construction and immediately thereafter. In very few cases are gravel roads closed to traffic during construction. This permits traffic to assist in compacting the surface. Very seldom is a roller used on a gravel road. Where the deposit contains very little clay binder, it is necessary to add clay at the time of depositing the material on the subgrade. The clay is mixed with the gravel by a blade grader or a similar device. Some deposits have an overabundance of binder and in that event it must be screened out in order to get a satisfactory surfacing material. The maintenance of gravel roads like all other types should begin the moment the material is placed on the subgrade. Patrol maintenance alone will not be sufficient. It is very necessary on many of the roads to use gang crews in resurfacing and widening, etc. The following rules will apply to practically all gravel roads:

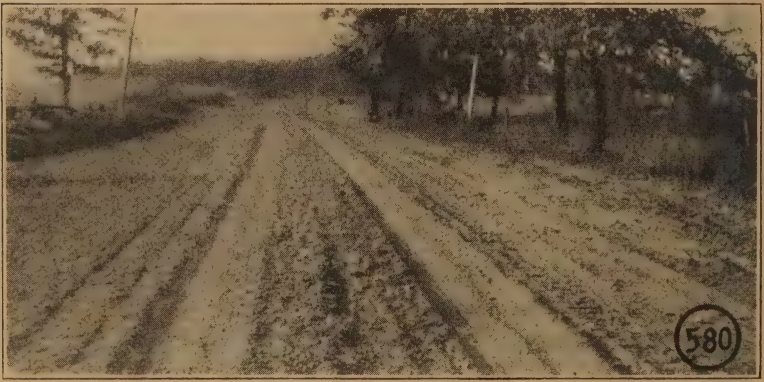


FIG. 2. Gravel road, before gravel has packed. Traffic and patrol maintenance will soon iron this out and a smooth surfane will result.

Important Factors. 1. *Be sure that the road goes into winter in the best of condition.* Ditches and culverts must be free and open. The surface must be smooth and free from holes and depressions, and it should have sufficient crown to take care of surface waters. In fact, during the fall season a gravel road should have slightly more crown than during the summer months. Have just enough crown to shed the water and no more. Experience has shown that four inches in 24 feet is sufficient. To the casual observer this would appear practically flat.

2. *The entire road should be graded with a large grading outfit,* moving the surface material from one side to the other, cutting down the high spots and filling the depressions, thus giving the patrolman a good surface to start with in the spring.

3. *Add new material at all places where the original surface has broken through under heavy traffic or by spring frost conditions.* In order to keep up the original depth, a light coat of material should be applied over the entire road.

4. *Keep a mulch of fine gravel about one-half to one inch in depth over the surface at all times,* and move this from side to side with the grader in the regular maintenance operations.

Surface Treatments. The ordinary gravel surface will be economical and serve adequately for light traffic, but when traffic reaches an average of 300 or more vehicles per day, some form of surface treatment is necessary to (1) preserve the original investment by conserving the material, (2) to provide for safety by eliminating the dust nuisance, and (3) to increase the efficiency of the highway.

Up to this amount of traffic there is probably no question but what the addition of material from time to time will keep the road in very good condition at a lower cost per mile per year than by any form of surface treatment. However, an important factor to keep in mind is the annual loss of material on the many miles of gravel road. This loss cannot go on indefinitely without seriously hampering the economy of gravel road construction. The most common palliatives used thus far by the various states are: Calcium

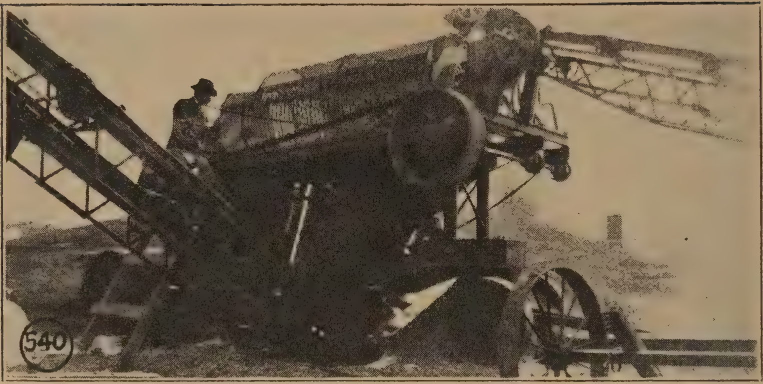


FIG. 1. Gravel crushing machine with revolving screen. The screen rejects material that is too fine, as well as that which is too coarse.

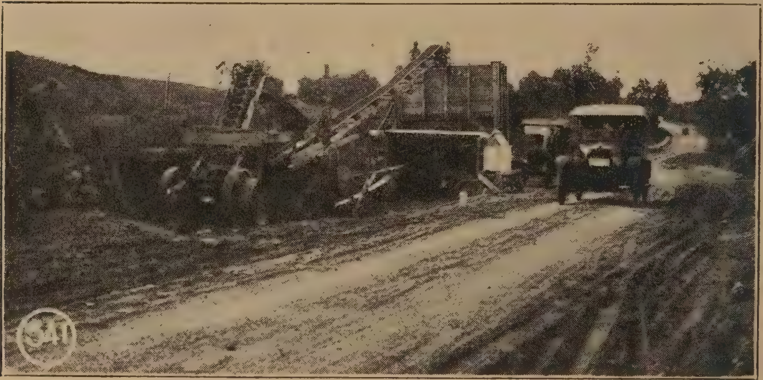


FIG. 2. A gravel crushing plant in operation. The gravel is delivered by a drag line bucket. The crushed material is elevated into the bin by means of a belt, for loading into the trucks.

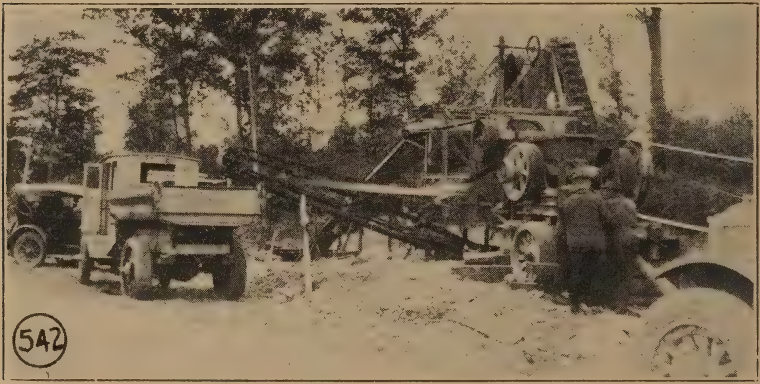


FIG. 3. Discharging crushed gravel directly into the truck. his plant can operate only when there are motor trucks on hand. Production would be increased if bins were installed.

Chloride,—Light asphaltic road oils,—Light tars and Medium asphalts.

CALCIUM CHLORIDE TREATMENT

Method. Calcium chloride has been used quite extensively throughout this state and more so in some of the neighboring states in combatting the dust nuisance. This type of treatment is quite satisfactory, but it requires the regular patrol operations to keep the surface smoothed up at all times and requires at least two treatments per season. Calcium chloride should not be used on gravel surfaces having a large clay content as the moisture drawn from the air would tend to make the surface slippery and would have the same effect as a shower of rain. Before treating the road, it should be properly shaped to a uniform cross section and then the first application of about three- fourths to one pound of calcium chloride per square yard should be placed with an ordinary lime sower or similar device. This treatment should be followed with a second treatment of about the same quantity per square yard from a month to six weeks later. If the season should be an unusually dry one, a third application may be found necessary. Experience shows that approximately two pounds per square yard per season works out very satisfactorily on the average gravel road. Some prefer two applications where others believe three, using smaller quantities for each application,

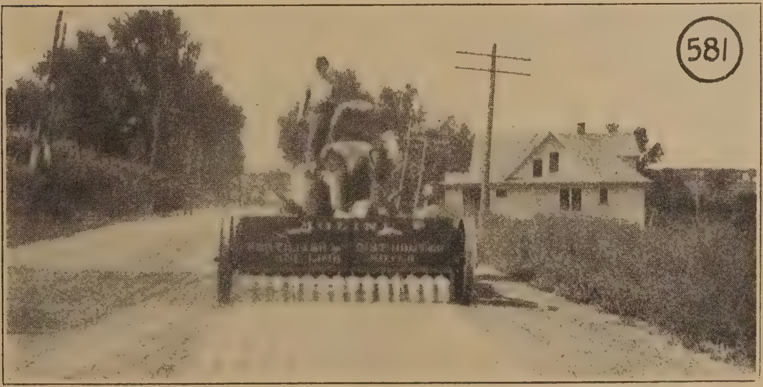


FIG. 3. Applying Calcium Chloride on a gravel road.

are more satisfactory. That is a problem that should be worked out for each individual case.

Costs. Considering the above as an average, the cost per season for materials and labor in applying the treatment would vary from three to five cents per square yard The time and expense of the patrolman in daily patrolling the surface should be included. This would add approximately $150.00 to $200.00 per mile per year, making a total cost per mile of between $400.00 and $600.00 depending upon the width treated. The calcium chloride treatment does very well in keeping down the dust and holding the material on the surface, but it must be repeated annually as it has no permanent effect.

LIGHT ASPHALTIC ROAD OILS

Method. Light asphaltic road oils have been used to some extent on gravel roads but to a larger extent on dirt roads. It may be said that this type of treatment will also keep the dust down and provide a satisfactory riding surface for a limited time. The oil also waterproofs the surface to the extent that it will shed water very rapidly during rainy spells. One disadvantage in this type of treatment is that the surface will gradually become smooth and shiny in spots and, as the oil evaporates, it will start to disintegrate and thus cause a very rough and uneven riding surface. This may be eliminated to a certain extent by keeping a light mulch of fine material on the surface at all times, and grading it from one side to the other, thus preventing a crust from forming. Usually about one-half gallon of oil per square yard will suffice on the average gravel road, although it often becomes necessary to make a light second application later in the season to preserve the original smooth surface.

Cost. The light oil surface treatment will cost approximately $350.00 per mile per year, plus the patrol maintenance cost which will bring the total per season between $500.00 and $600.00, or about four and a half to six cents per square yard. Treatments the following year will require less oil per square yard and thus the cost the second year will be decreased slightly. The road should be scari-

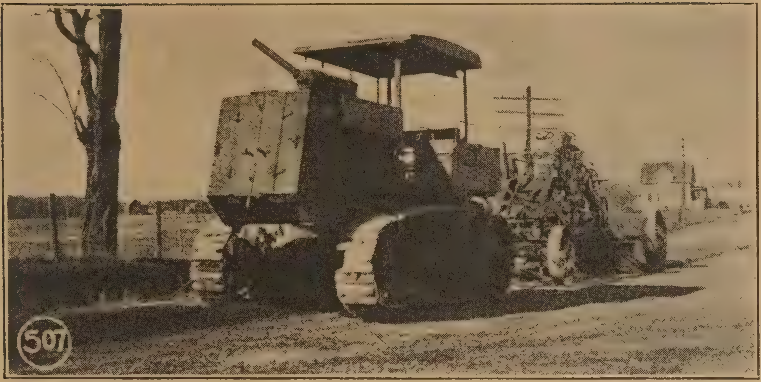


FIG. 1. Light tar treatment of a gravel road. Shaping road preparatory to application of tar.

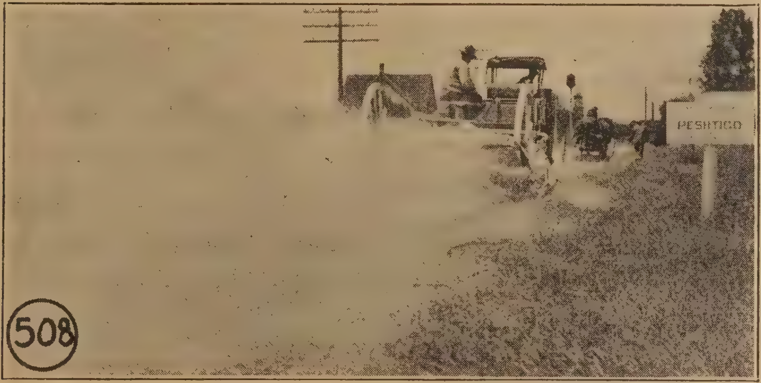


FIG. 2. Sweeping the road preparatory to the application of tar, following shaping. Note the sand placed for use following the second application. It should not be delivered until after the first application of tar. Note also the dust. This is good road material which is constantly being blown away and must be replaced under old methods of maintenance.

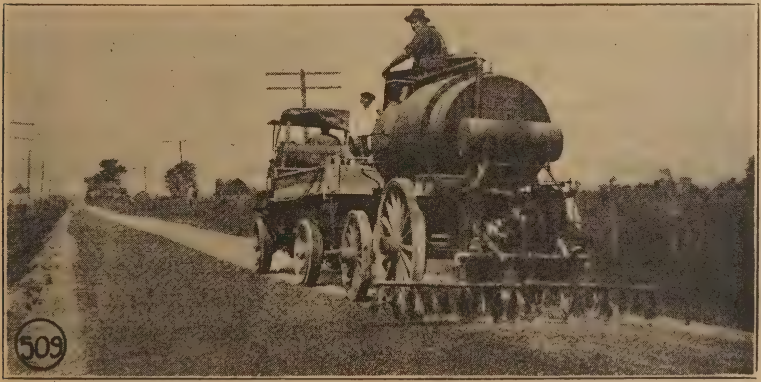


FIG. 3. Making the first application of tar. This is known as the Main Method or Skin Treatment. Require scarifying and retreatment each year.

fied annually and it is very necessary that these treatments be followed up from year to year if a uniform surface is to be maintained. If this is not done, the surface will soon disintegrate and become very rough.

LIGHT TAR TREATMENTS

Methods. More miles of gravel road have been treated with light tars than with any dust palliative except calcium chloride. In general there have been three methods employed; (1) that which provides a skin treatment where the penetration is less than 1 inch; (2) a treatment where a penetration of approximately 1½″ to 2″ is attained by mechanically mixing the tar and surface gravel with a grader and allowing traffic to compact the material; (3) where the surface materials are mechanically mixed the same as in case two, and a light roller is used to compact the treated portion. The first named treatment has been used a good deal in several states with considerable success but that type of treatment requires annual scarifying, reshaping and retreatment. The surface will not usually go through the winter season without being broken up by winter traffic and therefore requires scarifying each spring.

THE SKIN TREATMENT

The skin treatment may be briefly outlined as follows:

Method. The road to be treated is brought to uniform cross section and excess loose material is removed from the surface by a power sweeper. After the sweeping operations are completed, the surface of exposed metal should present a mosaic appearance. An application of about one-sixth of a gallon per square yard is then applied with a power distributor. Tar may be heated not to exceed 125°F. to facilitate distribution and penetration. This is allowed to penetrate for at least 48 hours. No absorbent is used after the first application of tar. If traffic cannot be conveniently shut off it is allowed to move over the road. The second application of about one-third gallon per square yard is applied from two days to a week later, this application being immediately followed with coarse sand or pea

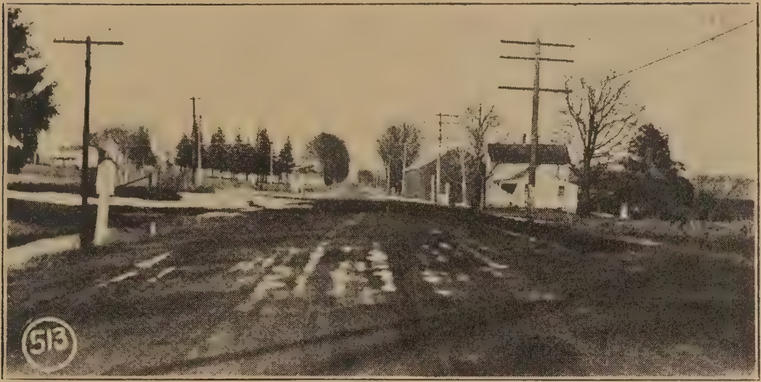


FIG. 1. A tar treated road after one winter. The traffic has shown through the tar covering in many places. This road is ready to be scarified preparatory to its yearly treatment. (Stin treatment)

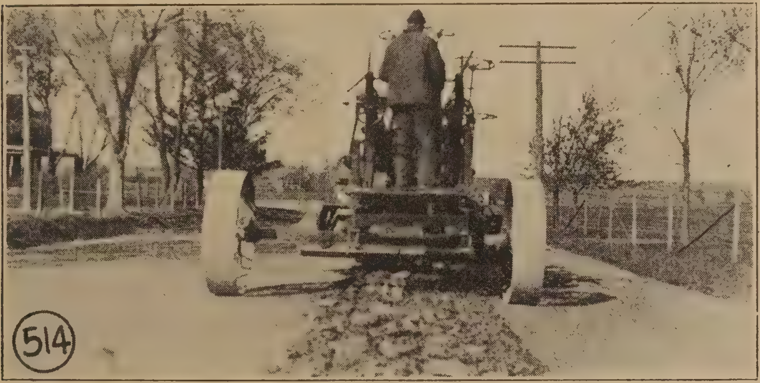


FIG. 2. Scarifying tar treated road preparatory to the second yearly treatment. Same as above.

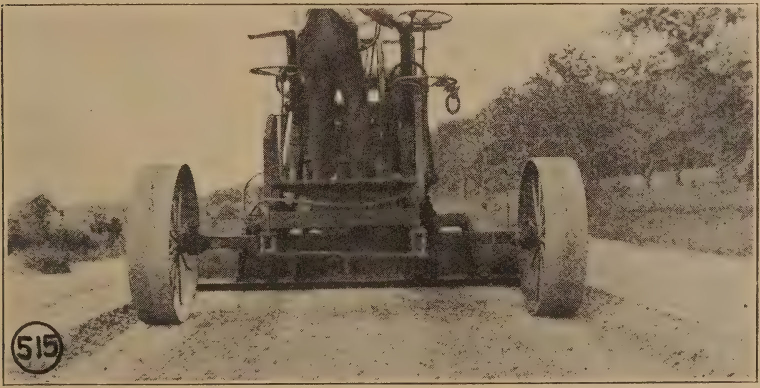


FIG. 3. Shaping a tar road that has been scarified, preparatory to the second yearly treatment. Same road as in Figs. 1 and 2.

gravel. If the tar shows a tendency to bleed, more sand should be applied. Within a few days, traffic will gradually iron out this surface making it appear very much like a bituminous macadam or an asphalt surface. The penetration, however, is from ½″ to ¾″. Any holes that may appear in the surface are patched from time to time by material consisting of a mixture of 17 gallons of light tar mixed with 1 cubic yard of coarse sand. This treatment has been used quite extensively in the states of Maine, New Hampshire and other eastern states with considerable success but it has been found necessary to scarify and retreat each year. The annual cost will vary from 8c to 11c per square yard for the first year. Subsequent treatments will decrease slightly in cost due to the fact that less tar is required in succeeding years.

WISCONSIN SPECIAL MIXING METHOD (Traffic Bound)

Method. This method was especially devised to do away with the annual scarifying and retreatment operations and it is especially adapted to gravel roads having an inch or two of loose material on the surface. Under this method the road is brought to uniform cross section and it is quite desirable to have some loose material on the surface. An application of about 1/4 to 1/3 gallon per square yard is then placed on the entire surface. The amount of tar will depend somewhat on the porosity and the absorbent power of the surface materials. Immediately following the first treatment, a large blade grader with blade set at an angle of approximately 45 degrees and at a depth of ¾″ to 1″ moves the material a few feet beyond the center of the road. The distributor immediately follows the large grader with an additional 1/4 to 1/3 gallon per square yard. The material previously moved to the center of the road is then moved back over the freshly applied tar. The same operation is followed for the other half of the road and in order to get a thorough mixture of the tar and surface gravel the entire surface should be moved back and forth several times with the grader. After traffic has been allowed to use the road for a week or ten days, the necessity of a light seal coat may be easily determined. Usually the movement of traffic over

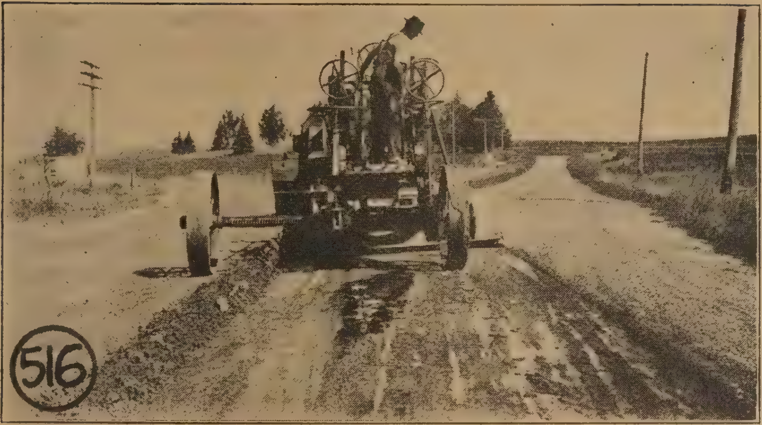


FIG. 1. Wisconsin special tar treatment of gravel road. (Traffic-bound) This view shows grader immediately following distributor, pushing the treated gravel to the center.

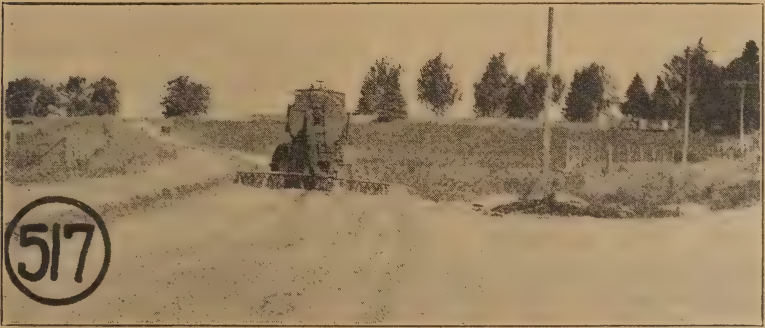


FIG. 2. The second application of tar is being placed on the newly exposed subgrade. Mixing method.

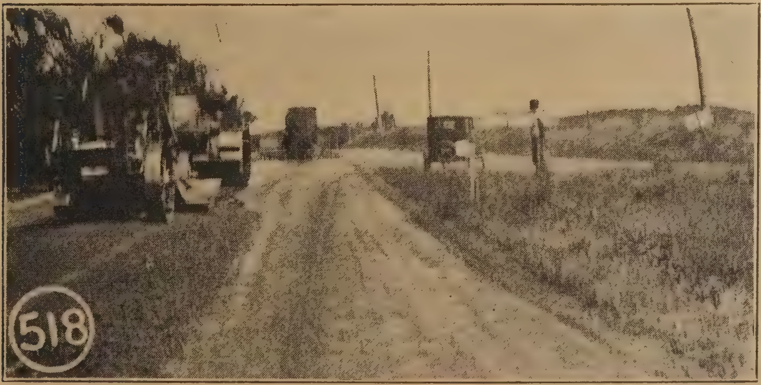


FIG. 3. Grader pushing material back over the second application. Mixing method.

the road irons out the surface to such an extent that some of the tar works up to the top and sufficiently seals the surface so that an additional treatment is not necessary. However, if it is found that the tar does not readily work to the surface a light seal coat followed with an absorbent of coarse sand or pea gravel is advisable. Extreme care should be exercised not to use too much tar, for if there is too much binder present the surface is apt to shove or wrinkle. With this method it has been found that a crust or mat of 1½″ to 2″ in thickness is built up. The amount of tar required varies from 2/3 to 3/4 gallon per square yard and the cost varies from 9c to 14c. While experimental pieces of road, treated with this method have only been in service for two or three years, it is safe to say that under this treatment a reasonably smooth surface may be maintained for several years with but a light application every two or three years.

Cost. The original cost per mile on an 18 foot width is from $900 to $1,200 per mile. The succeeding years the cost will depend on the amount of patching necessary and this is usually very small if the original treatment was properly placed so that over a four or five year period the average cost per mile is cut down to approximately $600 or $700. It is unnecessary to scarify this surface each year as is the case with the skin treatment outlined above.

Advantages. The one emphatic complaint that motorists have against oiling or tarring of any description is that their cars get spattered with oil or bitumen and this causes them extra expense and inconvenience. By treating a road under the mixing method this objection is practically eliminated, as traffic is allowed to use one-half of the road while the other half is being treated. Experience has also shown that by immediately mixing the bitumen with gravel that the resultant mixture is not readily picked up by the moving vehicle but on the contrary traffic tends to compact the surface.

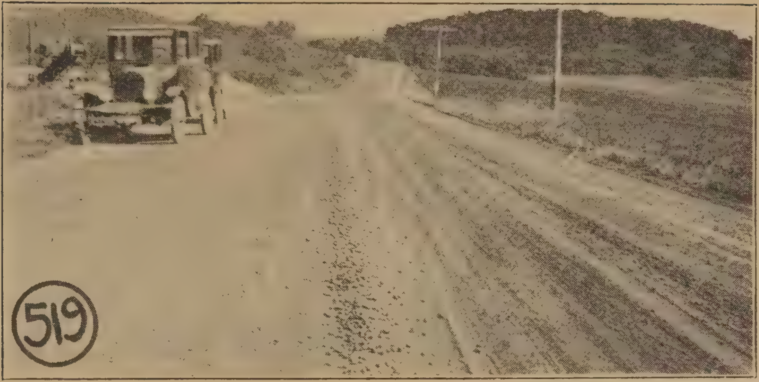


FIG. 1. Same road as in Figs. 1, 2 and 3, page 89, about four hours after the mixed material has been spread and shaped. Note how the road has ironed out under traffic.

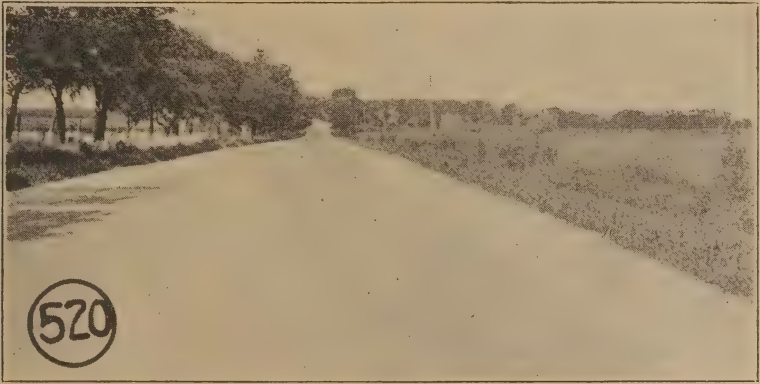


FIG. 2. Same road as above, about two weeks later.

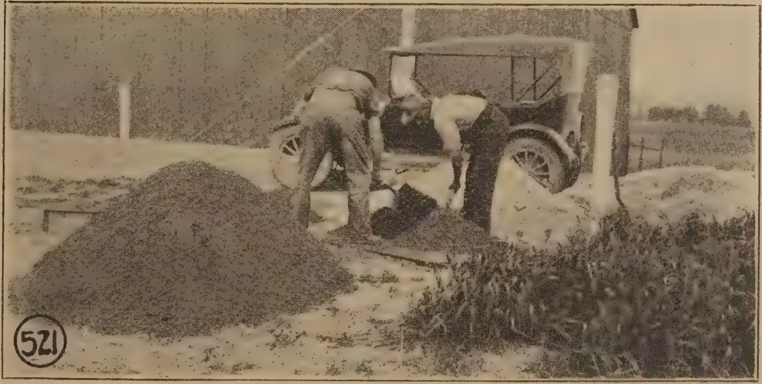


FIG. 3. Mixing patching material.

THE MIXING AND ROLLING METHOD

This method is the same as the mixing method except that instead of allowing traffic to iron out the surface, a light roller of not more than five tons in weight is used to compact the material. The advantage in this method is that the surface is smoothed by rolling the entire width immediately after the mixing has taken place and traffic will not be inclined to follow the same rut. In other words, it will be distributed evenly over the entire surface whereas in the traffic bound mixing methods vehicles are inclined to follow the ruts of the vehicle that preceded. The cost of the mixing and rolling method is practically the same as the preceding method.

MEDIUM ASPHALT

Method. Treatment with this material is somewhat different than with light tars. Usually it is applied in two applications about six weeks apart. After the first application a planer or drag is used constantly over the surface at the same time allowing traffic to iron it out. The second application is placed about six weeks later and is followed with a covering of coarse sand. While there have been but a few miles of gravel roads treated by this method in Wisconsin, it is believed that satisfactory results may be obtained with medium asphalt.

Value of Surface Treatments. Surface treatments render a definite service to the road user as well as to the one who lives along the highways. The expenditures can be easily justified where traffic is heavy enough to warrant the treatment. This is especially true when you consider that on the average plain gravel road which has a traffic of 500 or more vehicles per day that the annual loss in material on an 18 foot width is from 300 to 400 cubic yards per mile. Figuring this at $2.00 per cubic yard in place we would have $600 to $800 per mile loss in material each year if it is not surface treated. No community is so well supplied with materials that they can afford to lose this amount each year indefinitely. Even if the road will eventually be paved with a durable pavement, materials must be conserved for the secondary and local roads. In addition to making the saving in material there is elimination of the dust nuisance which has been responsible (1) for many of the highway accidents and unsanitary conditions, (2) for deterioration of motor equipment, clothing, buildings, furnishings and farm crops, and (3) for decrease in efficiency of the highway. When you consider what this means on the many thousands of miles of gravel roads on the various state systems it is obvious that a surface treatment renders not only a true highway service but it is a sound business proposition. It does not take the place of a durable pavement but it bridges the gap between the plain low type surface and the durable pavement. It is a maintenance and not a construction problem. It must be kept in mind that the great bulk of highway mileage is either surfaced with a low type surface or not surfaced at all and this will continue to be true for many years to come. A comparatively small mileage of our main highways will be paved each year with high type surface, but finances will not permit the building, within a few years, of all primary or state systems of highways with a durable pavement. Until this can be accomplished we must adequately take care of highway traffic in the best possible manner within the means at hand and from the experience already had by many of the states it may safely be stated that a gravel road may be made a smooth, safe and dustless road at a moderate annual cost, in fact, at a less annual cost than the interest on the investment in a high type road for a limited time. By this it is not meant that paving with high type surfaces should be discouraged, but on the contrary surface treatments should serve only as a stepping stone to higher types. A gravel surface treatment is not a pavement and cannot be treated as such. To do work by any of the above methods and not make provisions for follow up maintenance is to invite failure. However, where the work is properly done and properly followed up a gravel road can be strengthened to carry increased traffic economically and safely. About 450 miles of gravel surface were treated with light tar by the mixing method in Wisconsin during the seasons of 1923, 1924 and 1925 and it is believed from the results obtained thus far that in this type of treatment is a solution of the dust problem on gravel roads.

The problem is plainly one of making the best of that which we have and to proceed gradually along sound business lines and provide for the motoring public a safe, efficient, dustless highway until a high type pavement can be built.

CHAPTER IX

MAINTENANCE AND REPAIR OF MACADAM ROADS

Types. The two types of macadam roads built in Wisconsin are the waterbound and the bituminous. In the early stages of the state aid law quite a mileage of waterbound macadam roads was build. This type, however, has been rapidly replaced by gravel and other light surfacings, especially so since the passage of the state trunk highway law in 1917 providing for the maintenance of the State Trunk Highway System. The small mileage of macadam roads being built today is accounted for by the fact that this type of road cannot be easily maintained by blade grader operation which is the basis of all state highway maintenance.

WATERBOUND MACADAM

Method. The only method of successfully maintaining a waterbound macadam road is by surface treatment which adds considerably to the cost and which does not give enough additional service to use this type in lieu of gravel. In order that the limestone in certain sections of the state may be utilized as surfacing material, it is crushed to the size of the standard specification gravel and the road is built in the same manner as a gravel road is built. This permits patrol maintenance with a grader or planer. In some cases the entire depth of surfacing is of the same material, namely, that passing a one inch opening, but where heavy traffic is anticipated a base course of heavier stone should be used. A few miles are being built each year using three to four inch stone in the base course and the finer materials in the top. In surface treating a waterbound macadam road, it is quite necessary to employ a gang of several men. This work cannot be done by the patrolman. The following method of surface treatment has given satisfactory results and may be used on all water-

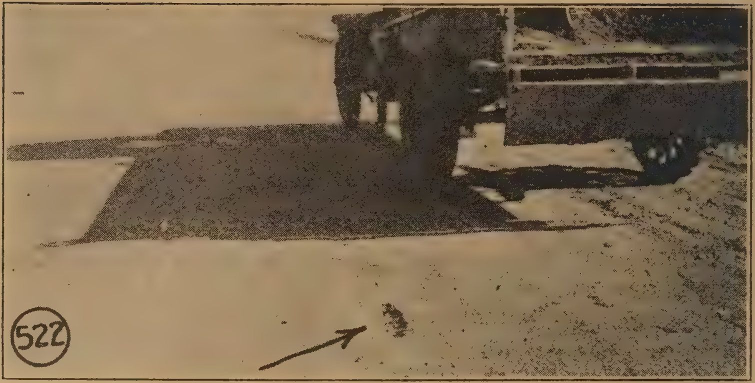


FIG. 1. Patching a tar treated gravel road. The hole to be patched is still small but the sooner these holes are patched the better.

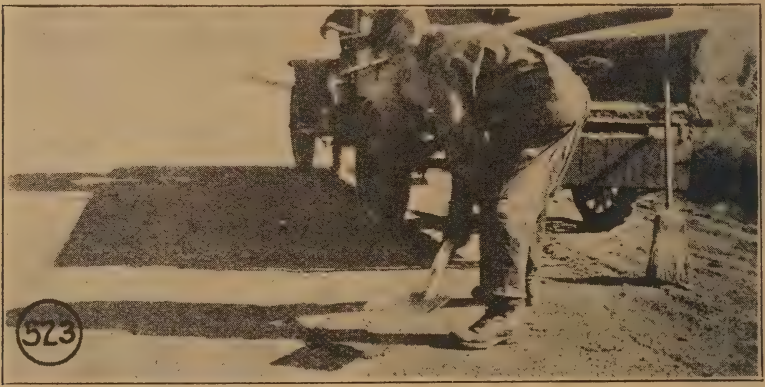


FIG. 2. The finished patch. The hole has been cleaned out, the patching material applied, and patted into place with the back of the shovel. Traffic will do the rest.

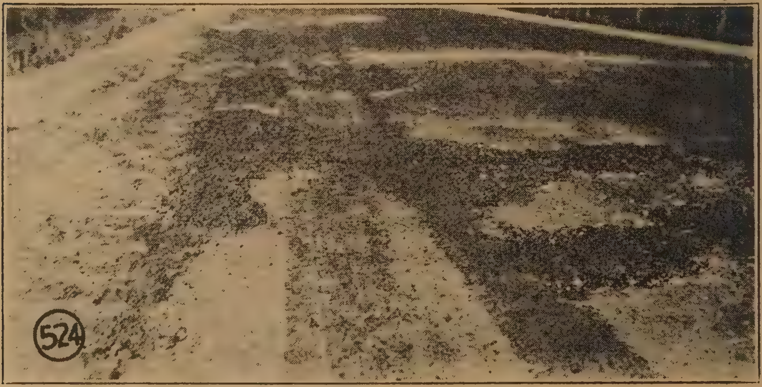


FIG. 3. Extensive patching. These large patches resulted from a poor surface. Traffic will iron the patches out so they can scarcely be distinguished from the rest of the road.

bound macadam roads. The necessary patches are made in the road by either of the following methods:

Cold Patch. For deep patches, crushed stone passing a one inch ring and retained on a quarter inch ring, is mixed with 15 to 20 per cent of clean, sharp sand and 16 to 18 gallons of bitumen per cubic yard. This should be allowed to cure for several days as it will make a more satisfactory material to work with. Usually this is made at a central mixing plant and delivered to the road by truck. Where only small quantities are necessary, it may be mixed by hand on a plank platform. For shallow patches, a mixture of bitumen with coarse torpedo sand, all passing a one-half inch ring, is used. The holes should be swept clean, if necessary, any loose material should be removed. Whereever possible, the bottom of the hole should be made larger than the opening at the top. This will key the patch into the old pavement. The hole should then be painted with bitumen. If the hole is several inches deep, the larger patch material should be used on the bottom and the finer material on top. The patch should be thoroughly tamped and, if necessary, a seal application followed by sand may be applied.

Heavy Asphaltic Oil or Refined Tar. The holes should be cleaned and painted with bitumen the same as described under the cold patch method. Place the loose stone and tamp well. Apply sufficient bitumen to cover the surfaces of all stone, making sure that too much is not used. Cover this with stone chips one-fourth to one-half inch in size and again tamp. Care should be exercised in making the patch come flush with the surface of the old road. A small straight edge is often very helpful in bringing this about.

Surface Treatment. Sweep the surface clean with a power sweeper and wherever necessary use hand brooms to clean out materials left by the power sweeper. Close the road, if possible. Then apply a light tar or asphaltic oil with a pressure distributor. The first application should consist of about one-fourth gallon per square yard, this to be followed by a second application of about one-third gallon per square yard in 24 to 48 hours. This should be immediately covered with pea gravel, stone chips or coarse

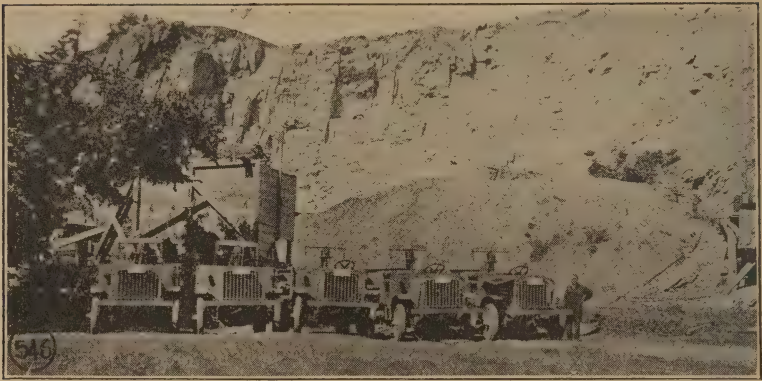


FIG. 1. The Sauk County quarry. Rock is crushed and screened for surfacing highways in the same manner as gravel. A permanent installation.

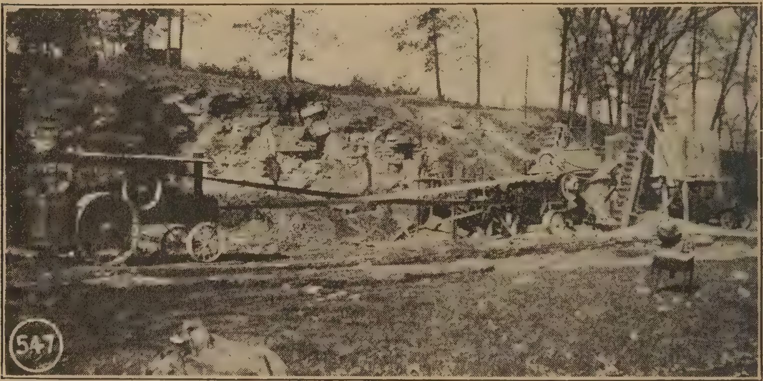


FIG. 2. A portable crushig plant. This plant furnishes a finely crushed limestone which is handled in the same maner as crushed gravel.

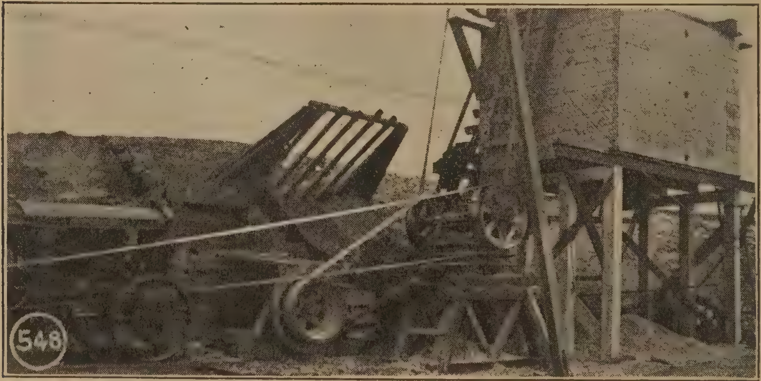


FIG. 3. A double crushig outfit. The coarse gravel is delivered to the primary crusher through the Gizzly in the cente. The crushed material is screened, and the material larger than one inch discharged into the secondary crusher shown in the right foreground. The secondary crusher dischages into the elevato and it is again passed through the revolving screen.

torpedo sand. Where traffic is allowed to use the road, one-half of the road should be treated at a time.

Follow-up Maintenance. After the surface has been treated in this manner, it should then be turned over to the patrolman and he should carefully watch the entire section for spots that are not properly treated and for places needing additional covering material. He should be supplied with a quantity of the bitumen used in the surface treatment, with a pouring kettle, broom, and a few stock piles of covering material. Where the bitumen shows a tendency to bleed more covering material must be applied until this condition ceases. If any patches appear to disintegrate, they should be immediately taken care of.

Maintenance of Waterbound Macadam without Surface Treatment: Many miles of old nine foot waterbound macadam have been scarified, widened and re-surfaced with gravel. The old standard macadam roads were approximately nine inches compacted, and when this material is scarified and spread over an 18 ft. width it makes a base of approximately four and one-half to five inches. This was surfaced with four to five inches of crushed gravel passing a one inch ring. This type of road has given very good satisfaction in the past and may be considered slightly better than the gravel road having the same material

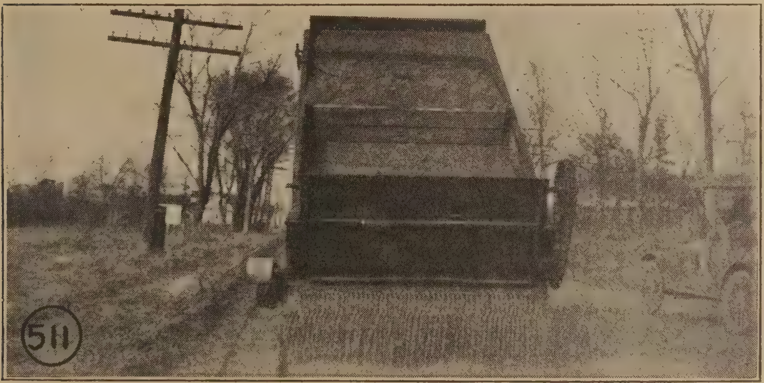


FIG. 1. Mechanical sand spreader in action. By this method the sand can be applied much more promptly and uniformly than by hand. Designed by J. C. Luden, Dane Co. Mechanic.

throughout. Standard patrol maintenance methods may be applied to this road also because of the gravel being on the top course.

BITUMINOUS MACADAM

Bituminous macadam surfacings require practically the same methods of maintenance as surface-treated macadam. The patrolman must watch the surface carefully and repair immediately every small defect that appears. From time to time a light application of bitumen should be applied to this type of road in order to preserve the life of the road. Care should be taken not to apply too much bitumen at any one time as this practice would tend to cause a very uneven and rough surface.

CHAPTER X

MAINTENANCE AND REPAIR OF CONCRETE PAVEMENTS

Introductory. Wisconsin has built to date approximately 2200 miles of concrete pavement on the rural highways. Approximately 1825 miles are located on the State Trunk Highway System. This type of pavement is found on the heavily travelled highways. Due to the availability of gravel and crushed stone for concrete aggregates in practically all sections of the state, this type of pavement will in years to come be the main surfacing on the principal state and federal highways. Its durability and low maintenance cost make it an economical pavement for rural highways. Each year there are being constructed from two to three hundred miles of Portland cement concrete, roads and inasmuch as the investment in this type of pavement is large, it is very essential, in order to protect the investment and prolong the life of the road, that proper maintenance should be administered. The usual defects that occur on the concrete slab are as follows: Cracks, Broken Corners, Holes and Depressions, Heaved Slabs or "Blow-ups" and Sunken Slabs.

FIG. 1. S. T. H. 15 Fond du Lac Co.

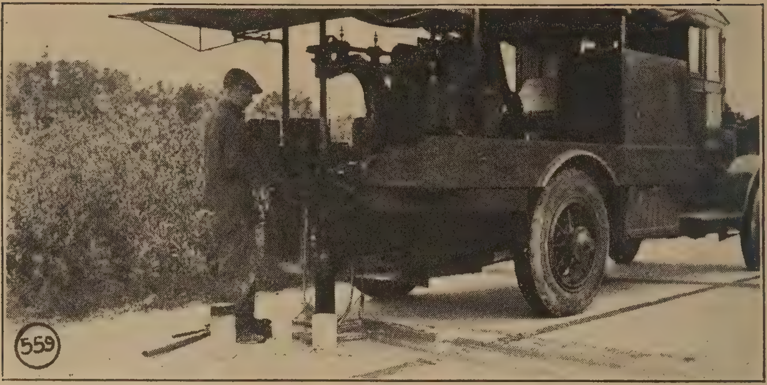


FIG. 1. A core drill. Designed and built by the Commission. Samples of concrete paving can be taken out of the road, measured and tested. Note the samples.

CRACKS AND JOINTS

Expansion. Most states are building concrete roads with expansion joints at stated intervals. These joints are in take care of expansion and contraction in the slab during hot and cold weather. In placing joints in the slab the engineer tries to anticipate the cracks which would ordinarily come through natural causes. However, it often happens that cracks do occur in other parts of the slab, and in order to prolong the life of the pavement the cracks and joints must be properly taken care of. The usual method is to fill all joints and cracks with a bitumen or a combination of sand or chips and bitumen every spring and fall and during summer if necessary.

Method. Cracks and joints may be maintained according to the following method: Remove all old bitumen adjacent to the crack or joint with a square pointed shovel or a flat hoe or sidewalk cleaner. The cracks and joints should be thoroughly cleaned by the use of wire push brooms or house brooms, or, in a case where there is considerable work, an air or steam jet should be employed. The use of the latter is very effective in removing the old hardened bitumen.

Equipment. In order to properly take care of the cracks and joints, the county should be equipped to do the work. The following is a list of equipment considered as essential to the successful performance of this work:

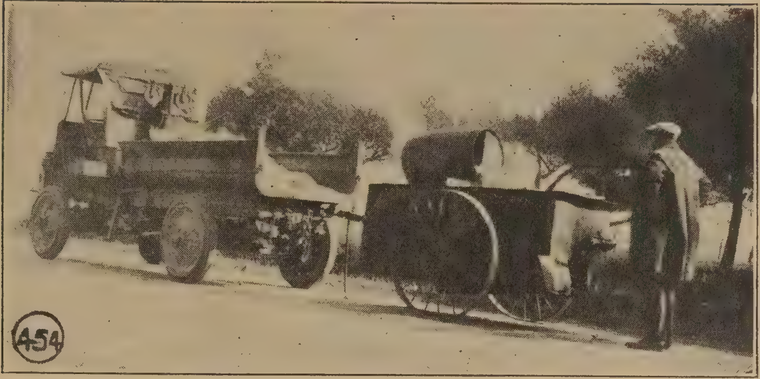


FIG. 1. Equipment for tarring cracks and joints, tar kettle in the rear. The truck furishes motive power, besides transportation for materials.

One—100 gal. heating kettle. This should be in a double boiler with the water chamber between the fire and the bitumen to prevent coking.
One long iron hook for cleaning cracks.
One flattened hoe or sidewalk cleaner.
One–half dozen square-pointed shovels.
Two wire push brooms.
One heavy house broom.
One pick.
Two wheelbarrows.
Two 3-gallon pouring kettles, one with conical spout and one with sprinkler nose.
One concrete tamper.
Two 3-gallon galvanized pails.
One tamper iron with edge about ¾″ by 10″.

This equipment will be adequate for one crew.

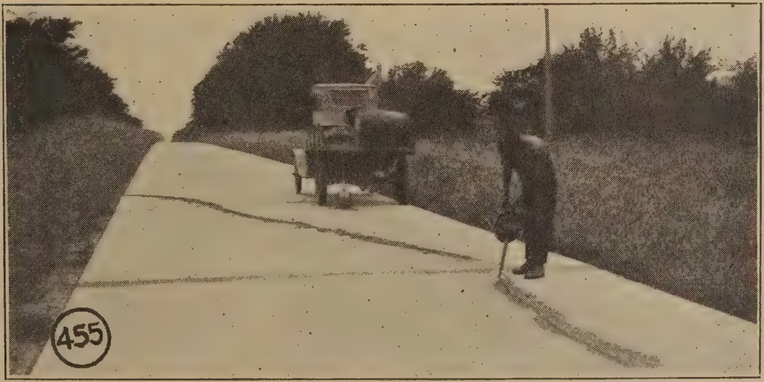


FIG. 2. Applying the tar. Three men can work to advantage; one sweeping, one applying the tar, and one applying the sand. The unsightly diagonal cracks almost never appear in roads built with the central joint.

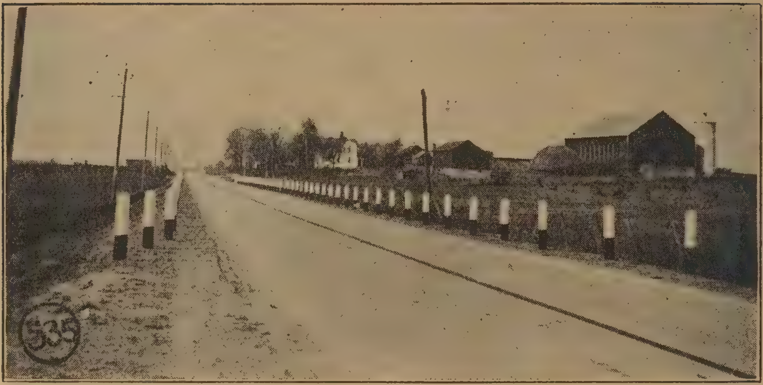


FIG. 1. Typical scene in Southeastern Wisconsin.

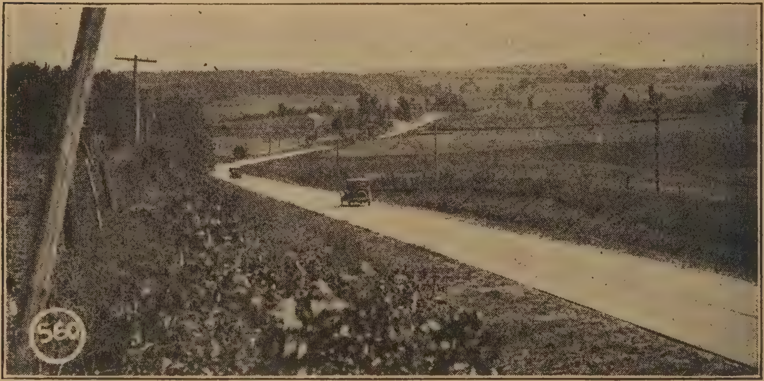


FIG. 2. Federal project No. 136. A concrete road in Western Wisconsin. Vernon County. S. T. H. 11.

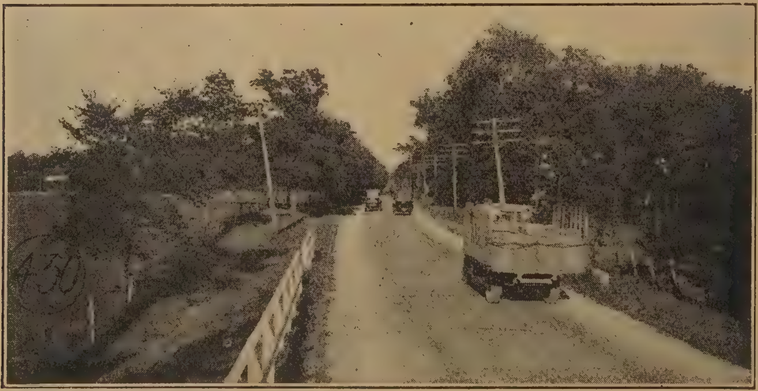


FIG. 3. A well maintained 18-ft. concrete road in Milwaukee County.

After the bitumen is properly heated, which should be between 200 and 250 degrees, depending somewhat on the type of bitumen used, it should then be poured into the cracks or joints, allowing the bitumen to come flush with the surface of the pavement. In placing the filler be careful not to let it overflow on the slab.

Small Cracks. For small cracks, tars or asphalts with sand may be used. In many cases a mastic of sand and bitumen, made while the bitumen is very hot, may be used. Should the bitumen penetrate and recede from the surface, more filler should be used.

Wide Cracks. A bituminous concrete or mixture may be made of stone or chips and bitumen in the proportion, by volume, of twelve parts of stone chips to one of bitumen. This should be tamped into the wide crack or joint and the top should be dressed off with sand or fine chips.

Cement Grout. Cement grout has been used with success in the repair of cracks. Difficulty is encountered, however, in many cases in getting a thorough bond between the new and the old concrete. For this reason it is not always advisable.

Pre-mixed Commercial Materials. There are quite a number of pre-mixed fillers on the market today. Before purchasing any of these products, the county should thoroughly investigate and have tests made by the laboratory. In order to use these materials properly, a thorough knowledge of the ingredients is necessary.

BROKEN CORNERS

Broken corners very often occur on narrow pavements where the impact of heavy concentrated traffic weakens the slab and causes breakages. Where these breakages occur, they may be patched by the use of concrete or by bituminous patch materials.

Cement Patches. Considerable repair work has been done on the old concrete roads by taking out the broken parts and placing a concrete patch made by the regular method. In the use of the ordinary Portland cement, it has been necessary, however, to either detour or shut off traffic for a sufficient time to allow proper curing of the concrete.

The matter of keeping a road open to traffic under the conditions existing in those localities having a large mileage of concrete roads is a very important factor, and for this reason it is advisable in many cases to use the quick hardening cements. The cost of this type of cement is almost prohibitive on extensive repair work but for small jobs it may be used with economy. Considerable research work is being done at the present time with the ordinary Portland cements to develop a quick hardening cement which will sell at approximately the same price as the ordinary Portland cement.

A quick hardening concrete can be made of the ordinary Portland cement by observing the following principles: First, decrease the amount of mixing water. Second, increase the amount of cement. Third, increase mixing time. Fourth, keep patch dampened for three days and at a temperature of approximately 70° F. Fifth, use calcium chloride.

The best way to use calcium chloride in the field is to use 100 pounds of commercial calcium chloride to about 40 gallons of water in a barrel of at least 50 gallon capacity. Stir until the calcium chloride is thoroughly dissolved. Add sufficient water to make 50 gallons of solution and a standard solution with 2 pounds of calcium chloride to a gallon of water is obtained. By replacing 1 gallon of mixing water per sack of cement in a batch of concrete with one gallon of this standard solution gives the right amount of calcium chloride and the right method of using. A satisfactory mix would be 1—1½—2½. It should be added slowly to the batch and care should be taken to see that the batch is made dry. The finished mix should permit a one inch slump test. All aggregates should be thoroughly mixed before being deposited and then should be thoroughly tamped in place. After three days the concrete will have hardened enough to permit ordinary travel over it.

Bituminous Patches. Bituminous patches may be used in the repair of concrete roads in practically the same manner as outlined under macadam roads. The patches may be made as outlined in the previous chapter, namely, by either the cold patch method or by using heavy asphaltic oils or refined tars. Where a patch is being made, the

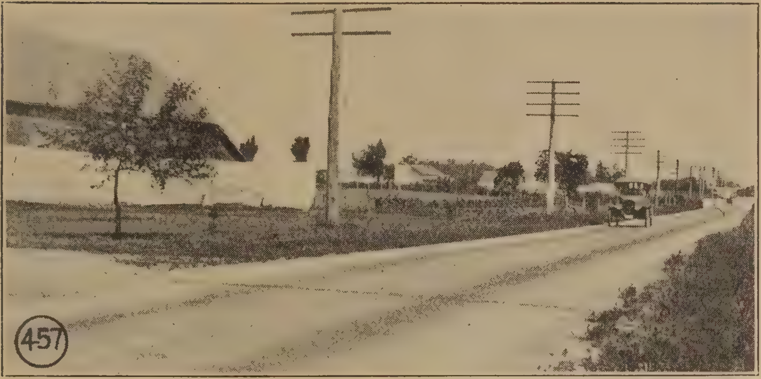


FIG. 1. Wash day. A paved road is a clean road. A dusty road is dirty and unhealthy. Winnebago County.

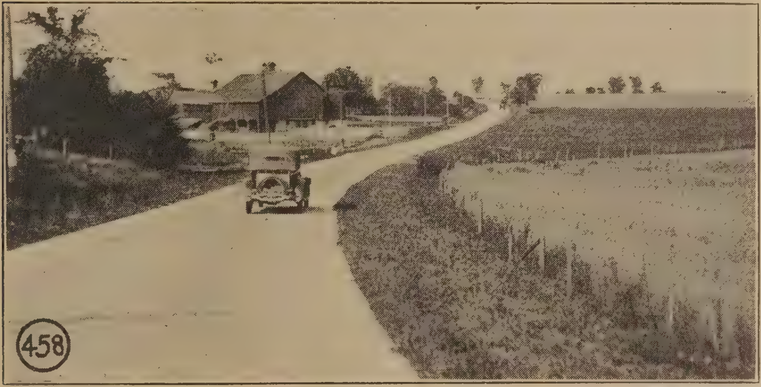


FIG. 2. Typical Wisconsin farm scene. Jefferson County. Many Wisconsin counties large mileages of paved roads are agricultural counties.

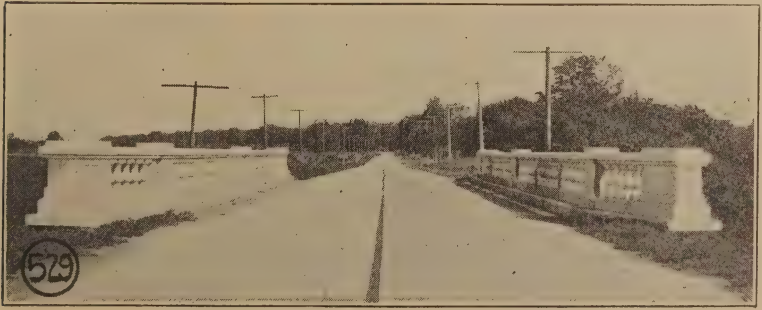


FIG. 3. Concrete road in Walworth Co.

entire depth of the slab, it is advisable to use coarse stone in the base and the finer materials on the top course. Do not use too much bitumen as this will cause the patch to heave or wrinkle. Use straight edge to bring patch flush with old surface.

Holes and Depressions. Concrete roads may be repaired in the same manner as holes and depressions in macadam roads. It is not advisable to use cement patches in repairing shallow holes and depressions inasmuch as they would soon crack and disintegrate. The reader is referred to Chapter IX where bituminous patches are discussed.

Heaved Slabs or "Blow-Ups". Usually occur during hot weather when expansion in the slab is the greatest. The raising of one slab above the other is often due to a poor or faulty expansion joint. The most common cases are those where the joint is not vertical. In many cases heaved slabs will eventually settle back into place but it is necessary in most cases to make temporary repairs to eliminate the uneven riding surface. Where the displacement is very pronounced it is necessary to cut away a part of the slab to allow settlement. When the settlement takes place the joint may be built up by using bituminous patch materials.

Sunken Slabs. Usually occur at bridge approaches and in fills across swampy sections. The time for taking care of this defect is during construction. However, in many

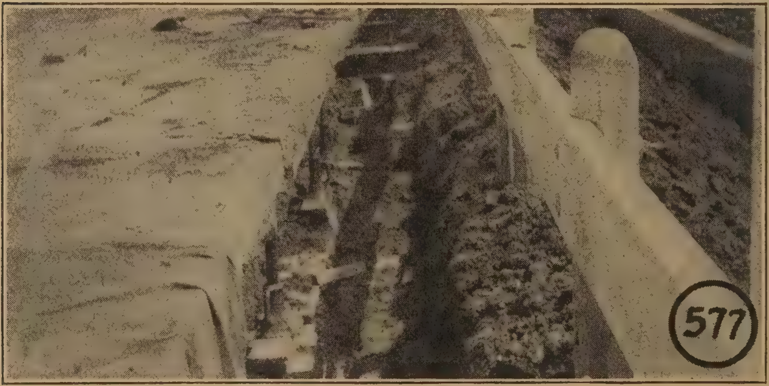


FIG. 2. Jacking up a concrete slab which has settled at the approach to a bridge.

cases they cannot be anticipated and it is necessary to make repairs after a pavement has been in several years. A sunken slab may be raised by placing an I-beam under the slab and jacking it into place. Then material may be pushed under the slab and tamped in so that settlement will not again take place. In the case of bridge approaches, this defect may often be prevented by building one or more beams from one wing of the abutment across to the other and letting the slab rest on the beam. This will apply especially in bridges having the "U" type abutment. Where sunken slabs are anticipated in heavy fills, it is often advisable to case a beam under the slab so that when settlement takes place jacks may be conveniently used to raise the slab. Where the slab is broken badly and cannot be raised, the broken portions should be removed and replaced by new concrete.

Widening, Surface-treating and Resurfacing. Most concrete roads become inadequate, not because of failure by impact or wear, but because of width. In those localities where concrete roads have been built, funds were not available at the time of construction to provide a width that would sufficiently carry traffic ten years in the future. For this reason many of the roads built five or ten years ago are too narrow and must be widened. The shoulder maintenance on a narrow concrete road is excessive and in order to keep down the cost and protect traffic, widening with either concrete or a bituminous surfacing is advisable.

Surface Treatment and Resurfacing. Some of the old roads that were built when the specifications for aggregates were not as rigid as they are today have shown a tendency to wear on the surface. These may be taken care of by applying a bitumen in the same manner that surface treatments are applied to macadam roads. In a few cases where the original pavement is badly worn and is also below the desired grade, a new slab of from four to six inches may be successfully placed over the old pavement.

Widening. As previously stated, it is not always possible to build a road wide enough to sufficiently carry traffic of the future and for this reason it is now necessary to widen many of our old concrete roads. This may be successfully done by trenching out the shoulder and by placing a strip of new concrete adjacent to the old. It may be placed all on one side or a narrow strip on either side. Advantage should be taken at this time to straighten out slight curves and widen pavements at corners.

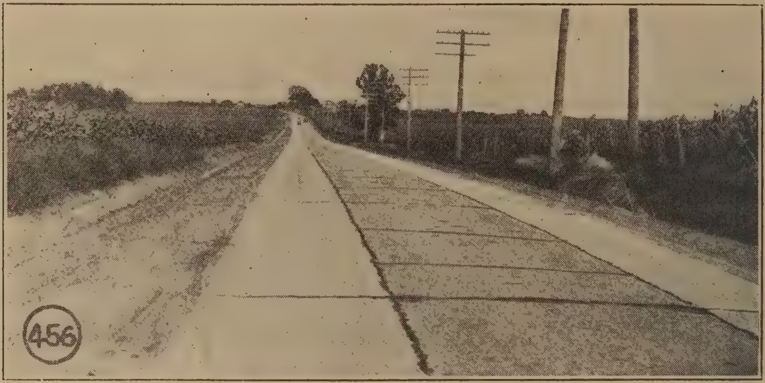


FIG. 1. Widening concrete pavement. S. T. H. No. 15, Outagamie County. Built nine feet wide in 1914. Widened to 20 feet in 1924. It may have to be widened again before 1934.

CENTERLINE MARKING

Probably one of the most effective methods of keeping traffic to the right is by placing a centerline marking over the entire length of the pavement. Some states believe that placing a centerline at curves and hills only will suffice. However, where concrete roads are built, traffic is usually heavy enough over the entire road to demand a separation of traffic in opposite directions to avoid accidents. There are several devices on the market today which may be used for placing the centerline marking. Some are hand driven while others are power driven. Bitumens have been used successfully in marking the centerline, also black pavement paints. Where bitumen, is used, usually an absorbent is necessary in order to prevent smearing and to retain a well-defined line. These lines should be renewed from time to time in order that they may be visible to traffic at all times. Black materials have been the most commonly used in the marking of centerlines. However, some experiments have

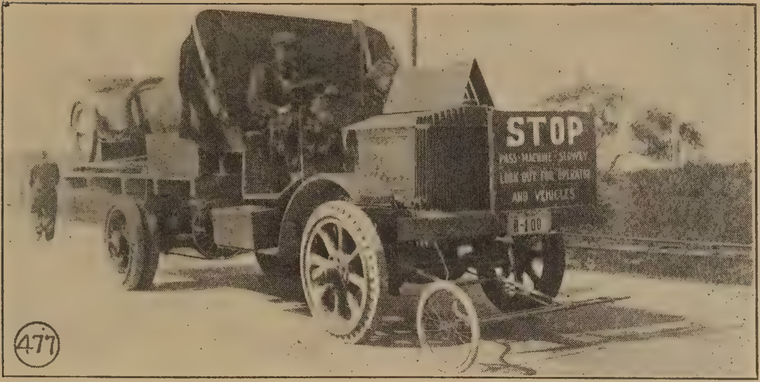


FIG. 1. Center line marking equipment, front view. When the adjustable bicycle wheel is at the edge of the pavement, the marking wheel is in the center.

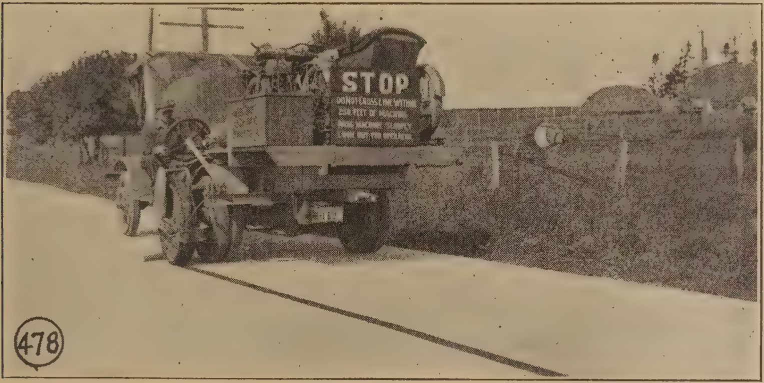


FIG. 2. Rear view, showing marking wheel. The marking is done with quick drying paint which is sprayed on to the marking wheel. The man at the wheel regulates the application.

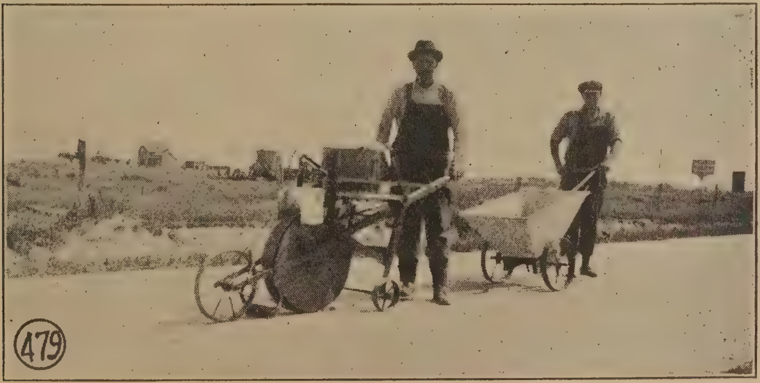


FIG. 3. Center line marking equipment. Hand machine. The marking is done with tar which is sprayed o the marking wheel from the tank at the top of the machine. Sand for blotting material is applied immediately following the marking.

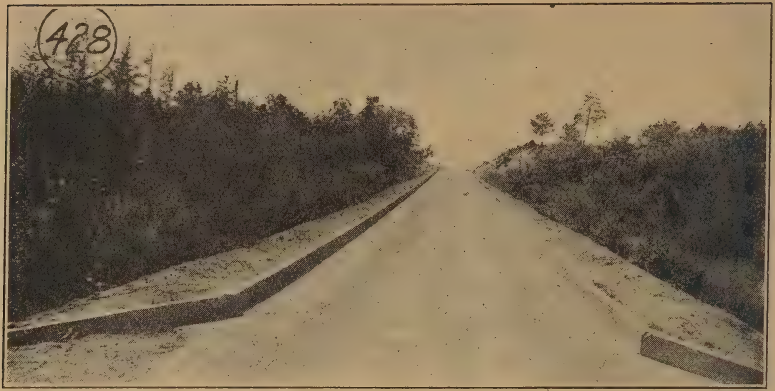


FIG. 1. A concrete road in Wood County. Note the curb which also takes the place of guard fence.

been tried with white and yellow paints. Some prefer the light while others prefer the black. Both have their advantages.

SHOULDERS

While the matter of shoulders has been discussed quite thoroughly in Chapter V, special mention should be made here of the necessity for maintaining shoulders on a concrete road. There is considerable difference between an 18-foot concrete pavement and an 18-foot surfacing with

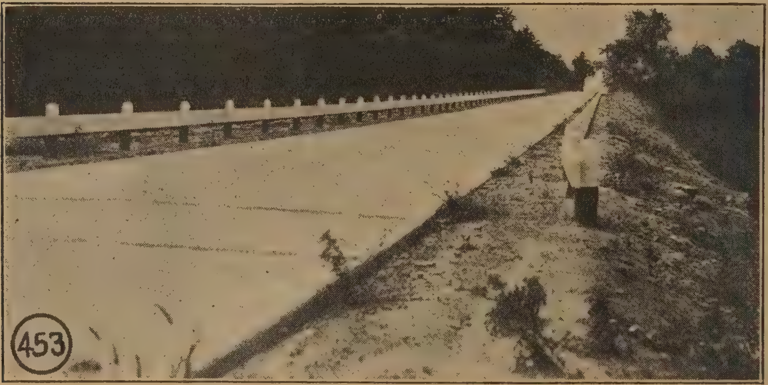


FIG. 2. Concrete road maintenance. Unless maintained, the shoulders settle, causing the condition shown in the illustration. Dangerous to travel and detrimental to the pavement.

gravel or other materials, for the reason that in the case of a concrete slab there is a very definite break between the surface proper and the shoulder, whereas in the case of a gravel or other road the break is not so pronounced, and in case a vehicle moves from the surface to the shoulder it may move back without encountering serious accident, but in the case of a concrete road, unless the shoulder is well maintained and kept flush with the edge of the slab, accidents are very likely to occur. Reports show that quite a number of fatalities have occurred through lack of shoulder maintenance. Therefore, constant vigilance should be exercised in keeping the ruts along the slab filled with gravel or other material and thus make the highway efficient over its entire width.

FIG. 1. Forest in Bayfield County S. T. H. 24.

CHAPTER XI

MAINTENANCE AND REPAIR OF BRIDGES, CULVERTS AND OTHER HIGHWAY STRUCTURES

Introductory. Bridges, culverts and other highway structures constitute a very important and necessary link in our highway system. Ofttimes the success or failure of the road may be attributable in some degree to the proper or improper size, type and location of the drainage or other highway structure. Large sums of money are expended annually in the building of new highways. A goodly percentage of this is spent in drainage structures which in most cases nowadays are of a permanent nature. No small amount is spent in certain localities on guard rail, riprap, retaining walls, slope walls, etc. to adequately protect the roadbed from erosion and the elements and to properly safeguard traffic. Too often the patrolman or maintenance man is satisfied only to maintain a smooth riding surface on his section with the result that culverts, bridges, guard rail and other structures are neglected. This is probably due to a large extent to the prevailing impression among the counties that once a structure is built very little attention need be given it. Many failures have been caused because the patrolman or county commissioner failed to spend a few moments making an inspection of a structure, especially after heavy rains or floods. Railroad officials have learned through experience the importance of their culverts, bridges and other structures, and in practically all cases they have installed very complete systems of inspection and maintenance. Highway officials should pattern somewhat after the railroads and make periodic inspections of all structures. Many times an expenditure of just a few dollars will save a structure involving several thousand dollars.

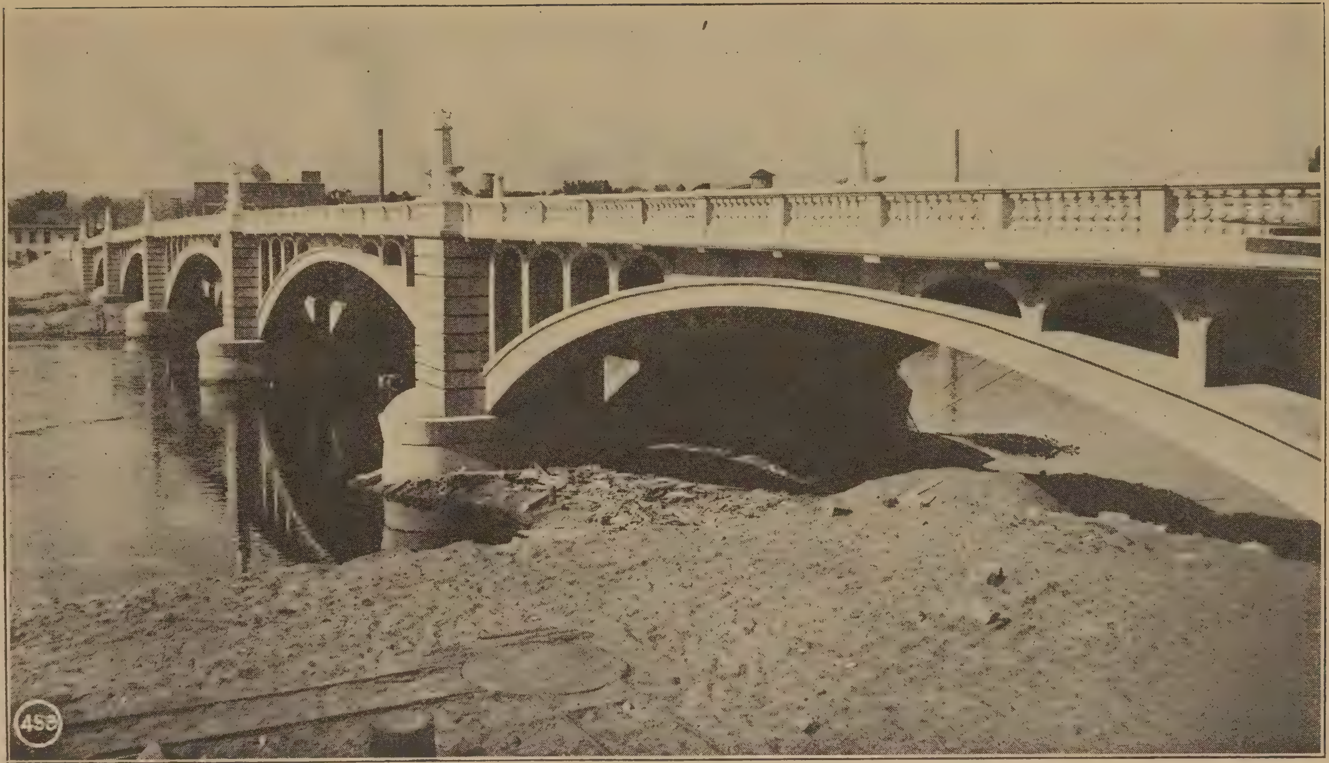


FIG. 1. Madison Street Bridge—City of Eau Claire. Legth 642 feet, roadway 36 feet, with two sidewalks of eight feet width, total cost about $275,000. Consists of five ribbed arch spans, ranging from 115 to 130 feet in length, with the longest span in the center, and the other spans placed symmetrically. Bridge construction of the most advanced type, designed and constructed by the Commission, under the contract system.

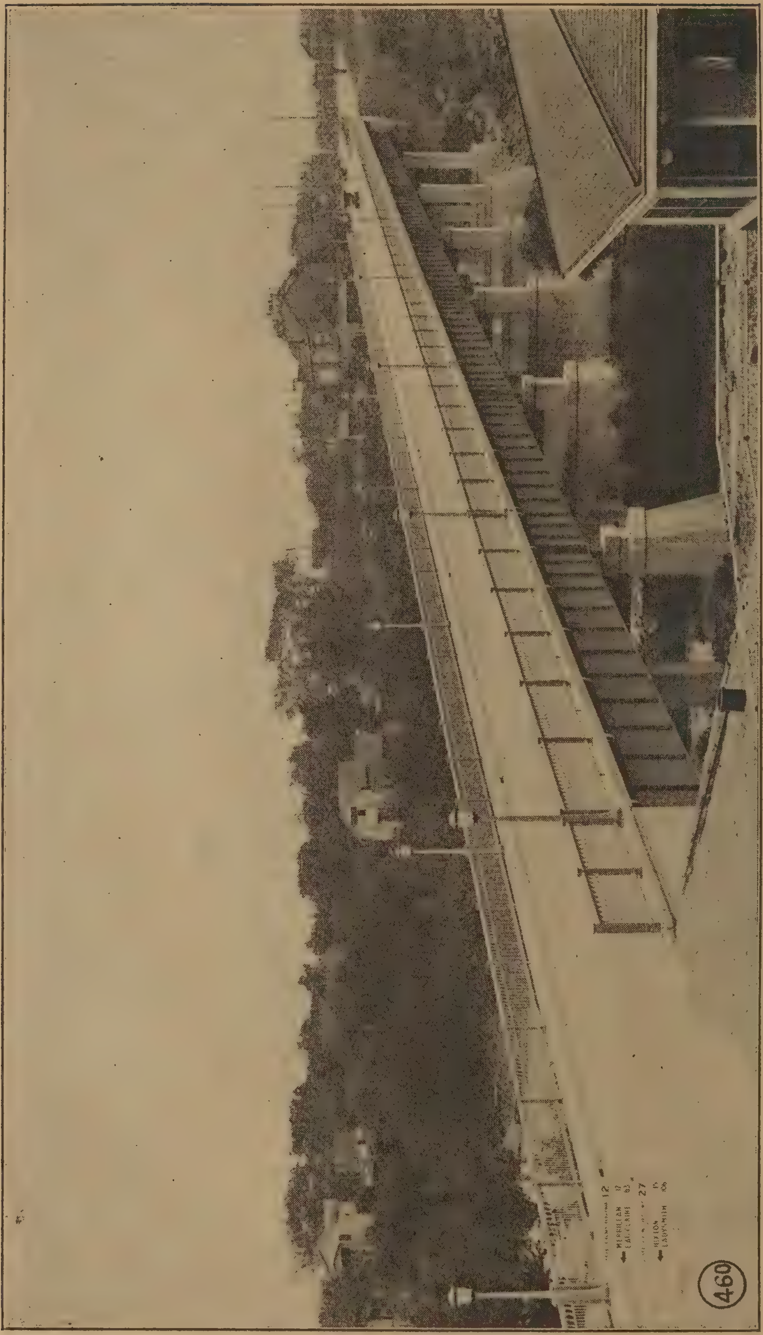


FIG. 1. The Black River Bridge in City of Black River Falls. Length 591 feet, roadway 27 feet, with two sidewalks of 6 feet width, cost $121,561.17. Many people believe that a steel bridge cannot be of good appearance—this structure proves the contrary. Designed and built by the Commission, under the contract system.

CULVERTS

Causes for Failure. Many of the drainage structure failures can be attributed to one or more of the following causes:

1. Poor materials and workmanship in both concrete and metal culverts.
2. Filling of culverts with subsequent frosts and thawing.
3. Erosion and under-scour during rains and floods.
4. Insufficient protection of headwalls, outlets, etc.
5. Obstruction at inside of culvert.
6. Poor or no outlet ditches.
7. Spalling of galvanizing, rust, rivet failures, disjointing of sections.
8. Improper location, alignment and grades.
9. Culvert capacity too small.

Systematic inspection and Maintenance. If the above causes are responsible for some of the culvert failures, and it is believed they are, it would naturally follow that these items should be included in a list of the things to be looked after in an organized system of inspection and maintenance. If periodic inspections are instituted, they will disclose the necessity of repairs which, if carried out, will lengthen the life of the structure. They will also assist the highway official or engineer in ascertaining the probable life of each structure and in so doing will give valuable information for future reference in the planning of budgets for culvert renewals and replacements.

The condition surveys made by the Highway Commission contain a partial record of all culverts and bridges on the State Highway System. The time was too short when these notes were taken to permit making the necessary inspection to determine the future life of the structures. As time goes on this information will be accumulated but it is very necessary that something be done at once to systematize the inspection and maintenance of our structures. The patrolman in his daily work can do very much toward prolonging the life of the structures on his section. The dumping of rock or stones gathered along his section may be advantageously done to prevent scour at the ends of culverts and at the foundations. The removal of obstructions and debris carried down by water should be taken care of after each rain.

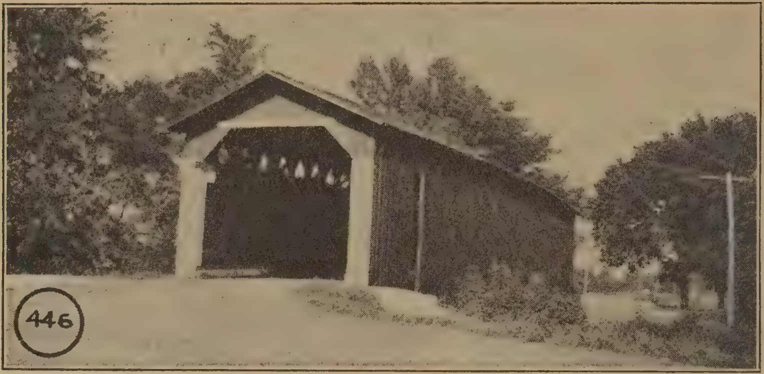


FIG. 1. Butterfield Bridge over Baraboo River, S. T. H. 33, Sauk County. Only a few of this type left today.

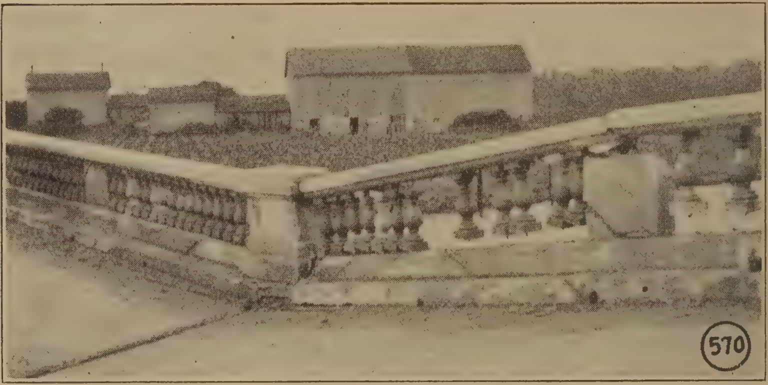


FIG. 2. Showing Concrete Bridge which failed by underscour of pier. A few dollars spent on rip-rap would have saved this structure.

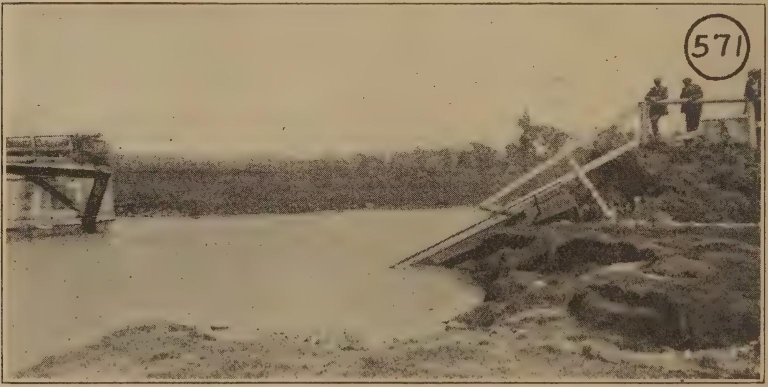


FIG. 3. Steel Bridge actually washed away by flood waters. Abutment was undermined and finally caused the failure.

BRIDGES

Practically the same items applicable to culverts may be used in bridge maintenance. The construction of bridges being somewhat different and on a much larger scale, they demand different treatment.

Foundations. These should be inspected periodically, especially during times of low water, and wherever necessary, stone or riprap should be placed to prevent scour. Brush, logs, driftwood, etc. should be removed. In the case of masonry walls and abutments, all cracks should be filled with cement grout and wherever necessary, the walls should be repointed. In some cases where underscour has taken place, it becomes necessary to strengthen the abutments and foundations by placing new footings under the old structure. This will add to the strength and protect the old parts.

Superstructures, Bridge Seats, Shoes, Rockers, Etc. Many of the steel superstructures go unpainted for years. The railings are allowed to stay loose and distored, the end bearings and rockers are allowed to become plugged up with dirt, leaves, etc., and floor drains are closed by accumulations of dirt. All these items are very important to the life of the structure and should be taken care of on time. If periodic inspections are made by the patrolman, he will find that by doing a little work at odd times these matters may be easily taken care of. The end bearings and rockers must be clean at all times. Often it will be advisable to jack up the structure to thoroughly clean the slip plates and beneath the rockers. The slip plates should then be coated with a suitable lubricant.

Painting. The job of painting a steel bridge is not one for the patrolman but in many cases he can very adequately take care of small patches on a steel bridge by painting them whenever the surface requires. The repainting of the structure is a job for a crew which specializes in this work. There are a number of steel structures on the highways today which do not warrant repainting due to the fact that they must be replaced within a short time. However, on the steel bridges built in the last ten or twelve years, money will be well spent in painting these structures. They

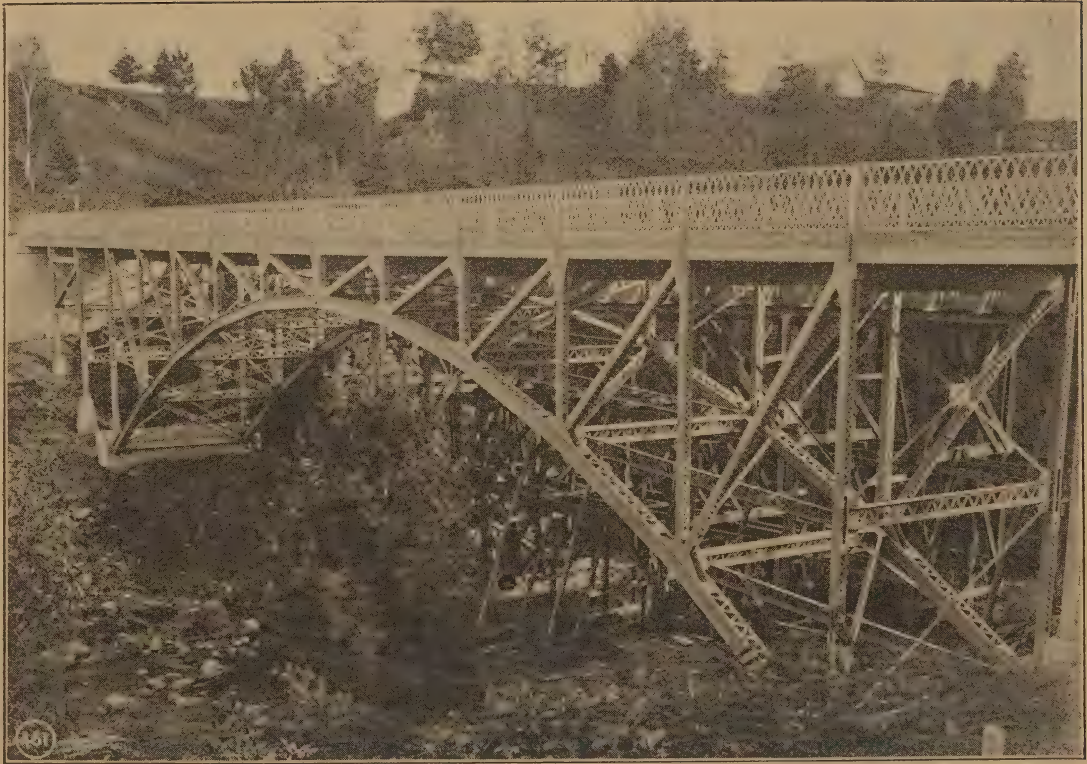


FIG. 1. Sioux River Bridge—Town of Washburn, Bayfield County. A steel arch bridge, length 246 feet, roadway 20 ft., cost about $23,900. The length of the arch span is 150 feet. The distance from grade to stream bed is 51 feet. An unusual type of structure appropriate to an unusual situation. Designed by the Commission, built by the county under the contract system.

should be thoroughly cleaned and then given three coats of paint in accordance with the standard specifications. After a thorough reconditioning with paint, one coat every three years should be sufficient. Any spots which show up during the three year interval should be retouched by the patrolman, using three coats if the steel is exposed. The steel work can be cleaned by hand, sand blasting or by wire brushes driven by an air compressor. Where the steel is badly rusted, it will be necessary to use a chipping hammer before applying the sand blast or air driven wire brushes. Air driven wire brushes do very good work. However, care must be taken by the operator to remove only the rust to renew the surface of the steel. In sand blast work a clean, sharp, well graded, dry sand is required. In many localities the air driven wire brushes are preferable to the sand blast work inasmuch as clean, sharp sand cannot be procured without excessive cost. The sand blast operation also requires larger compressors, especially if the paint spray is working at the same time.

Spray Gun. The paint may be applied with a spray gun or by hand. The spray gun is speedier and more paint is used in doing the work by this method. The occurrence of bubbles on the surface indicates moisture or cold steel. This condition may be remedied slightly by adding a small amount of turpentine in the paint. Much time can be saved in the actual painting operation by using the spray gun. However, more paint is used due to the fact that some is lost in the operation.

Floors. Very often the planks on old bridge floors become loose. To keep them in place a wheel guard should be used which will also prevent a wheel from dropping off the edge of the plank and against the railing. Where it is necessary to maintain a plank floor for several years, it will be advisable to use 2x4's set on edge. These should be creosoted or if it is not possible to get creosoted timber, a light, cold bitumen should be used to cover the 2x4's. A two inch bituminous wearing surface should be placed on the floor, either a cold patch or a hot mixed bitumen may be used. The aggregate should be well graded, and to secure the best results the work should preferably be done between June 15 and September 15. If a small one size aggregate is used, the bituminous mat should not be thicker than the largest dimension of the aggregate or it is apt to rut easily and crack under traffic. Concrete wheelguards on steel bridges are occasionally broken and these should be repaired to protect traffic from running off the bridge of the floor. At the ends of truss and plate girder spans, broken curbs and parapet walls are often found. These being due to the lack of expansion and the accumulation of dirt at the end bearings. These breaks should be repaired and sufficient room left for expansion.

Concrete Railings. On baluster railings the expansion filler is ofttimes forced out. This presents an unsightly appearance and should be trimmed down so that it is flush with the edge of the concrete.

Approaches. So far as possible there should be no abrupt break in the grade line on an approach to a bridge. In too many cases there seems to be a well defined point where road maintenance ends and bridge maintenance begins. These conditions should be remedied. The patrolman can haul a few loads of gravel or other materials to build up the approach to the bridge floor and thus eliminate the disagreeable bumps that are usually prevalent on many of our bridges. These are not only disagreeable but they are a source of great danger to traffic. In the case of concrete roads where the slab has settled, these may be taken care of as explained under Sunken Slabs in Chapter X. On practically all other types of roads the approaches may be built up of the material used in the road. It is often necessary in constructing new bridges to place the floor of the bridge at a higher elevation than the road adjacent with the expectancy that at some time the road will be raised to the level of the bridge floor. This should not excuse the patrolman from trying to keep a satisfactory approach to the bridge. In general, the patrolman is a road surface specialist, but there are times when he can devote his energy toward improving other details of his section. When his time is not necessary on the road surface, he should be taking care of details that are secondary to a smooth surface. The repair and maintenance of bridges is more or less a specialty, and counties having a large number of bridges should have a special crew for taking care of this work.

GUARD RAIL

Guard rails are placed along the highways for a definite purpose. The fact that it is considered necessary during the construction of a project is sufficient reason for its being properly maintained after once constructed. Guard rails properly placed and maintained add to the appearance of the highway while at the same time warn the traveler of dangerous conditions existing on the highway. Broken portions should be repaired and replaced immediately after being broken. Guard rails should be painted at least once every three years and in many cases more often. Weeds, brush, etc. should be kept down. The posts should be kept vertical. On small repairs the patrolman should be held responsible for their upkeep. Where extensive repairs or repainting are necessary, this should be taken care of by a special crew.

Retaining Walls, Riprap, Slope Walls, Etc. These are usually placed along the embankment to prevent slides, erosion, weathering, and action of other destructive elements. It is, therefore, necessary to see that they are properly maintained at all times. Cracks often occur in retaining walls. These should be sealed with either cement or bitumen to prevent the seepage of water behind them. Riprap should be inspected occasionally to see that it is holding up properly. Slope walls should be inspected and should be watched for scour, cracks, etc.

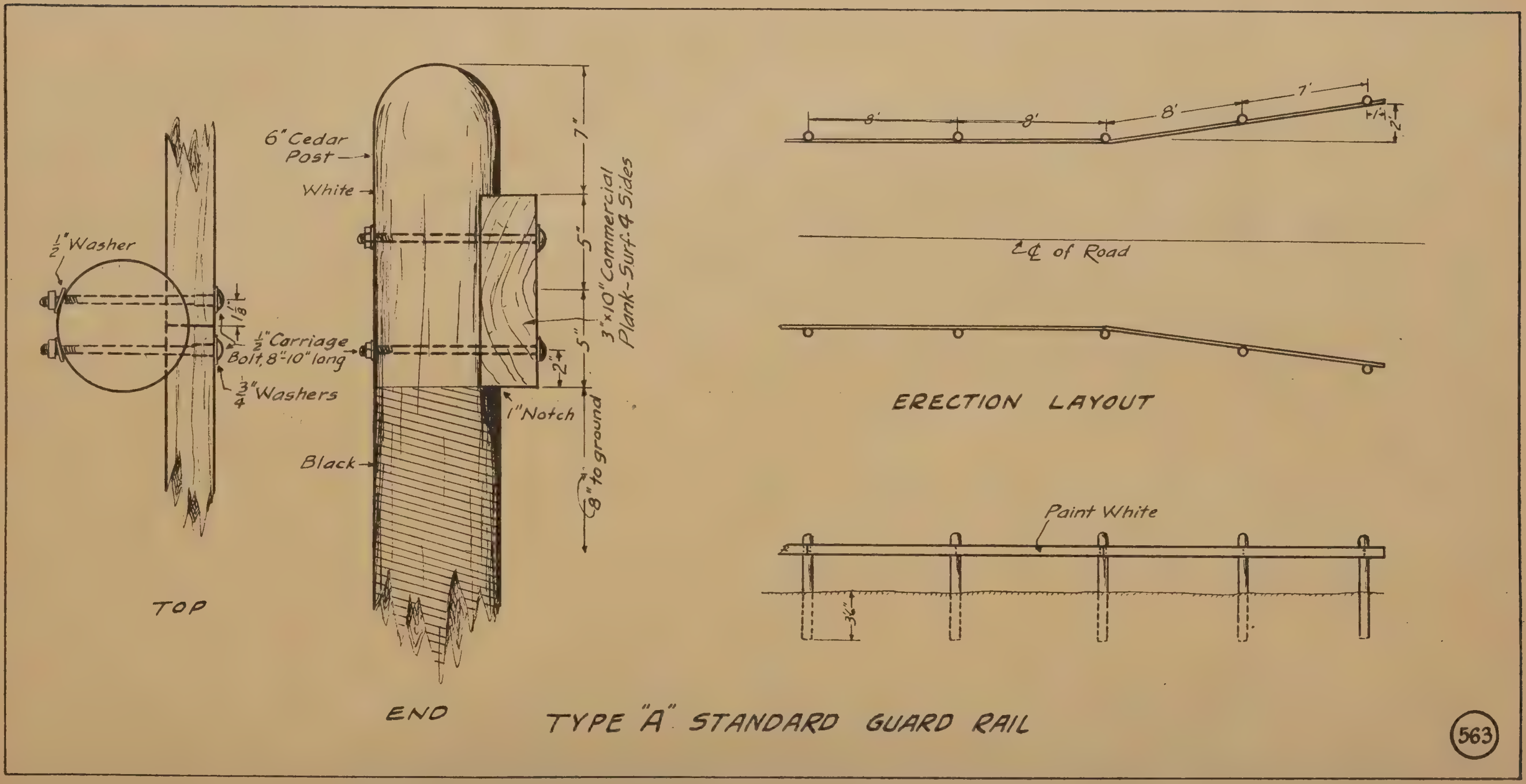
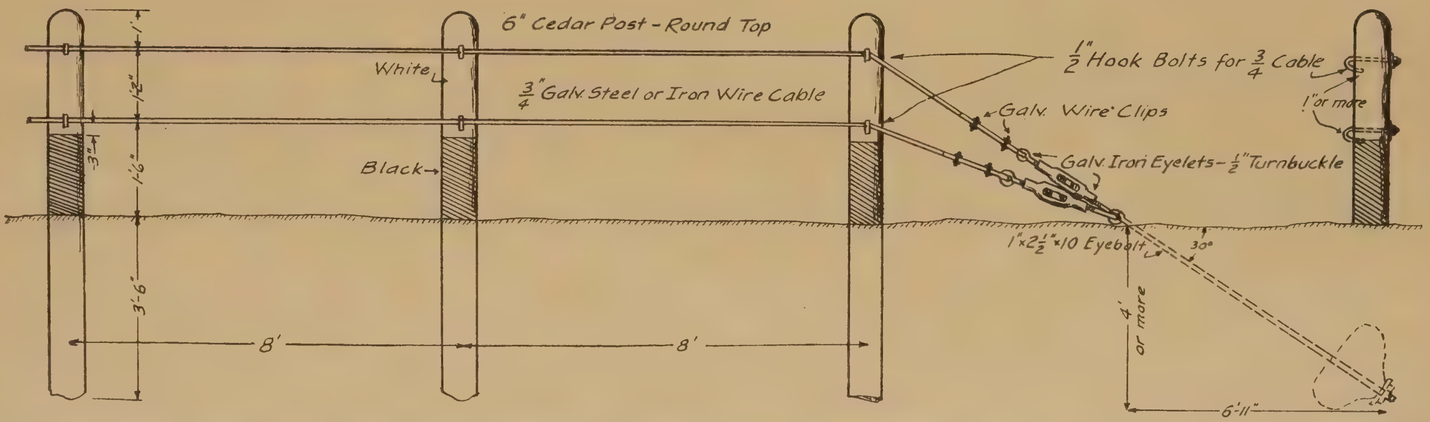


FIG. 1. Showing details of Type "A" Guard fence

TYPE "B" STANDARD GUARD FENCE


6" Cedar Post - Round Top
White
$\frac{3}{4}$" Galv. Steel or Iron Wire Cable
Black
$\frac{1}{2}$" Hook Bolts for $\frac{3}{4}$ Cable
Galv. Wire Clips
Galv. Iron Eyelets - $\frac{1}{2}$" Turnbuckle
1" or more
1"×2$\frac{1}{2}$"×10 Eyebolt
30°
4' or more
6'-11"
1'
1'-2"
1'-6"
3"
3'-6"
8'
8'

After erection, all posts and parts not galvanized shall have two coats of paint as per specifications; Posts to be not less than 6" Diam. at tops. and shall be shaved to the white from the ground line to the top.

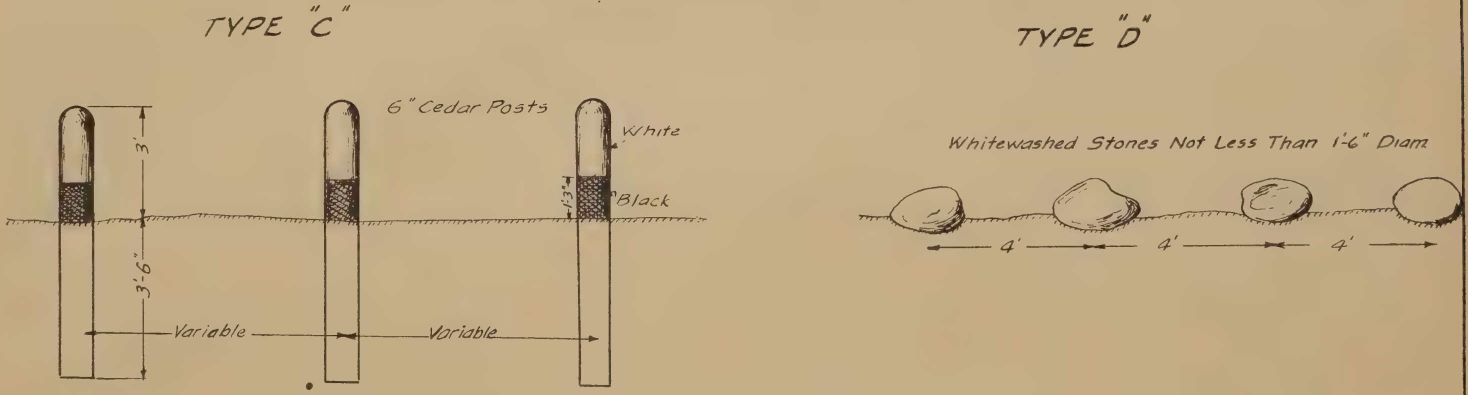
Area of face of deadman to be not less than 4 Sq. Ft. Thickness to be not less than 6"

Material Required For 10 Panels (80 Lineal Ft.) of Wire Cable Fence

160' of 3/4" Galvanized Wire Cable
11 Posts - New Cedar, Fir or White Oak - 7'×6"
8 Galv. Wire Clips
4 Galv. Eyelets
4 - $\frac{1}{2}$" Turnbuckles with Locknuts
22 - $\frac{1}{2}$" Hook Bolts for 3/4 Cable
2 - 1"×2$\frac{1}{2}$"×10' Eyebolts for Anchor
2 - Deadmen - Size as noted

564

FIG. 1. Showing details of Type "B" Guard Fence



SPECIFICATIONS

All posts shall be of good, sound, straight & seasoned new cedar, fir or white oak at least 6" top diameter. They shall be shaved to the white from ground to top. All lumber shall be good, new, sound fir, white Norway or yellow pine, surfaced, seasoned & free from large knots. All fence & rail to be well painted with 2 coats after erection.

White paint shall be made of white lead and pure boiled linseed oil - 18# of lead per gall. of oil.
Black " " " " " pure boiled linseed oil, lamp-black & Japan drier - 1 gal. oil - 1 lb. dry lampblack & 1 pt. drier. Lampblack must pass engineer's approval; ingredients thoroughly mixed at least 24 hrs. before using. Application must conform to first 3 sentences in 190r of the standard specifications.

(565)

FIG. 1. Showing details of Types "C" and "D" Guard Fence

CHAPTER XII

SNOW REMOVAL

Introductory. Snow removal on rural highways has in the past been considered a problem of more or less local importance. The time is fast approaching when most of the main highways will be kept open to travel during the winter season. In all cases, however, the demand for snow removal on rural highways must be governed (1) by the volume of traffic which can normally be expected to use the highway during the winter season, and (2) by the cost of keeping the roads open to traffic. It is a well-established fact that the best and most effective method of snow removal is snow drift prevention. This may be brought about (1) by proper location of the highways as regards alignment and elevation of grade, and (2) where it is impracticable to locate the highway in the proper place to take care of drifting snow, it is necessary to use snow fences.

Snow Fence. Placing of snow fences should be preceded by snow drift surveys, preferably the previous year. This will permit the placing of the fence in the correct location.

The old railroad type of snow fence has been used for many years along the railroads and highways. It has been very effective in preventing snow from accumulating on the highway. One objection that may be raised to this type of fence is that it requires considerable space for storage and is not economically handled. There are other types on the market today which are very satisfactory and economical from the standpoint of original cost and handling expense. The vertical slat type, of which there are two or three varieties on the market, may be erected and stored with minimum effort. It must be kept in mind that erecting and taking down snow fences is an annual proposition inasmuch as they are usually placed in farmers' fields that are cultivated during the summer season. For this reason the fence that lends itself to ease of handling and low cost is the most advisable type to use.

Hedges. Permanent hedges are not entirely practical in view of the fact that they must be set out at a sufficient distance to cause the drift to form outside of the right of way. This is especially impracticable in well-developed farming communities.

Snow Removal Equipment. Where the location of the highway and the protection from snow drifting do not suffice to keep the highway clear, mechanical equipment must be resorted to to properly clear the snow from the highways. One difficulty to overcome in the development of snow removal equipment is the fact that the equipment must lie idle a good share of the time and that too much money should not and cannot be invested in equipment of this kind. It is, therefore, necessary to develop such outfits as may readily be attached to other equipment ordinarily used in highway work.

Truck and Mould Board Type Plow. For the ordinary light snows, trucks with the mould board type plow mounted in front of the truck are the most economical type. In some cases "V" plows are advisable. Some states use two trucks in tandem, having a "V" plow on the front truck with side wings on the rear truck, thus making it possible to clear the highway 15 to 20 feet in width in one trip. These trucks operate at from 10 to 15 or 20 miles an hour in ordinary snow. However, where drifts are encountered, this speed must necessarily be cut down.

Truck and Tractor with Mould Board or "V" Type Plow. Where heavy drifts are encountered, the tractor or truck and "V" plow combination are not entirely satisfactory inasmuch as it requires a great force to push the snow off the highway where the snow is wet and soggy.

Tractor, "V" Plow and Rotary Attachment. It is believed that the tractor with the "V" plow supplemented by a rotary attachment is the most economical and the most efficient equipment to use where heavy drifts occur. The advantage of the rotary attachment is that it throws the snow a considerable distance from the roadbed and in many cases entirely off the right of way. In those states where snow removal is an annual proposition, there seems to be a tendency to adopt this type of equipment, especially through the sections where the drifting of snow occurs.

There is still room for improvement on the present type of tractor, "V" plow and rotor combination. Some of the equipment on the market at the present time provides a single power unit for both the tractor and the rotor. While this may be sufficient in a good many cases, it is believed that where extra heavy work is encountered, the rotor should be operated from a separate power unit due to the fact that where a single power unit is employed and considerable power is necessary to push the snow, the speed of the tractor is lessened and at the same time an increase in power is necessary for the rotor. Each case must be handled on its own merits. It is rather difficult to say that one type of equipment is best inasmuch as each has its place. There are certain localities where one type is more applicable than some other type and for this reason counties should investigate all types and decide for themselves the equipment that will best handle their work.

Cost of Snow Removal. In regard to the cost of snow removal work, it is rather difficult to establish a unit price inasmuch as the systems employed in the different counties and the sources of funds vary so greatly. Some of the counties do the work with county organizations whereas in a good many cases it is done by the local units and quite often private companies, such as bus and traction companies, contribute funds and labor toward the work. The counties should keep a record as to the amount of snow fall in their localities, the time and expense connected with its removal, the cost of snow fence, and the unit price per inch of depth of snow removal. This will give a basis for future budgets for snow removal work.

Future Requirements. Communication over the highways during the winter months is becoming more common each year. This is especially true in the well-settled communities and the localities where hard surfaced or so-called permanent roads have been built. One of the strong arguments for a hard surfaced road is that it may be used 365 days of a year. The motor vehicle owner is gradually increasing his demands and is requiring that this type of road shall be kept open for travel the year round. He feels that an investment of from $25,000 to $30,000 per mile should not lie idle for three or four months of the year. Wisconsin has approximately 2,200 miles of concrete roads. The time is not far distant when the traveling public of the state will demand that at least this mileage be kept free from snow during the winter months under a systematic snow removal program.

FIG. 2. Wilson Creek near Menomonie, Dunn County, S. T. H. 25.

FIG. 3. Irvin Park near Chippewa Falls, Chippewa County, S. T. H. 11.

CHAPTER XIII

REPORTS, RECORDS AND BUDGETS

No enterprise involving the expenditure of several million dollars can be carried to a successful conclusion without proper accounts, records and reports. Before launching on a program of either construction or maintenance it is very necessary that we know (1) what funds are available, (2) the nature of the work to be undertaken, and (3) who is going to do the work. There must be a strict accounting of all expenditures from the patrolman or laborer up to the chief executive of the highway department. No matter what a man's position is, his particular work requires the making of reports to his immediate superiors. The matter of adequate highway accounting cannot be stressed too strongly.

BUDGETS

Each county, before starting its work for the year, should make its maintenance budget, setting aside specific amounts for the different activities. On state highway work each county is requested to consult with the division engineers and to work out a budget for the maintenance work in that county. There should be set aside sufficient funds to take care of general maintenance, reconstruction, betterments, patrol superintendence and other items which may be divided according to the following schedule:

General Maintenance:

- a. Patrol Maintenance
    - Labor, materials, machine rental, etc.
- b. Gang Maintenance
    - (1) Shoulder and ditch work where a small gang is used once or twice a season.
    - (2) Shaping the surface or adding new material that will bring the surface up to its original condition.

(3) Filling cracks and tarring joints on concrete surfaces.
(4) Surface treatments (except the first surface treatment of any road which falls in the classification of Betterments).
(5) Maintenance of culverts, bridges and other structures such as guard rail, retaining walls, riprap, slope walls.
(6) Materials, labor, machinery rental.

Reconstruction:

a. Resurfacing or improving present road with the same type, width and thickness.
b. Replacing existing structures by one of equal type.

Betterments:

a. If grading work that materially widens the present surface of the road.
b. Surfacing earth roads that have not been previously surfaced.
c. Adding surface material that results in the surface being materially increased in depth or width over the former surface.
d. The first surface treatment on gravel or other type of roads.
e. Bituminous mat or carpet applied to a concrete surface.

There should also be set aside a sufficient fund to pay a proportionate share of the *patrol superintendent's* time and expense while supervising the work of state trunk highway patrolmen. *A reserve fund* should be held back to take care of emergencies as they may occur during the season.

REPORTS

Patrolman's Reports. The patrolman must make a daily report to the county highway commissioner. He must also fill in his monthly report and mail it promptly at the end of each month in order to receive his salary. He is also obliged to report all accidents occurring on his section, on standard forms supplied him. He may be asked to make other reports from time to time.

Reports from the County. The county must report to the Highway Commission on standard forms the time and expenses incurred for patrol superintendents, general maintenance expenditures, request for location of gang maintenance work, gang maintenance expenditures for reconstruction and for betterments, traffic counts, and special reports as requested.

RECORDS

Highway Commission Records. A ledger account of each patrol section is kept at each division office. A record of the maintenance inspections made of all patrol sections during the season is kept at both the division office and the main office. This enables the Highway Commission to at any time look up the record for any patrol section and to ascertain whether or not satisfactory work is being done.

Detour Record. A record of each detour is kept, the date started, a weekly report made as to its condition, and a report made when the detour is removed.

Accidents. A complete accident report is kept in the main office, thus enabling the Highway Commission to study the causes and to classify them. Many times these lead to the improvement of certain sections of road which would otherwise pass unnoticed.

Traffic Records. A complete record of all traffic counts is kept each year so that a comparative study may be made of traffic conditions by years.

Condition Survey Record. Since the beginning of the State Trunk Highway System, four complete condition surveys have been made of the entire system. A record of each mile of road, showing the structures thereon, the type of surfacing, width, condition, etc., is very accurately kept. When changes occur through improvement or otherwise, they are recorded from time to time.

On the following pages will be found most of the main reports and forms used in state trunk highway maintenance work.

PATROLMAN'S CONTRACT

THIS AGREEMENT, entered into this------------------day of --, 192------, by and between -- County, Wisconsin, represented by its County Highway Committee, party of the first part, and -- of ---------------------------------, Wisconsin, party of the second part.

WITNESSETH: That for and in consideration of the payments to be made by said party of the first part, hereinafter called the County, to said party of the second part, hereinafter called the Patrolman, said patrolman agrees to perform the duties of patrolman on Patrol Section No.---------------, --County, according to the direction and under the supervision of the County Highway Commissioner as hereinafter described.

Patrol Section No.------------extends from mile number----------- to mile number--------------------on State Trunk Highway number ---------------, a distance of----------------miles, more or less, the same being subject to revision when deemed necessary by the County.

The maintenance season of 192---- shall begin between April 1st and May 1st and end about December 1st, at the option of the County. The County may, if conditions warrant, order work done prior to April 1st or after December 1st.

The patrolman hereby agrees:

1. To give his entire time to the work and work ten (10) hours each day.
2. To furnish a satisfactory team and wagon, wear the number badge furnished by the County, mark his wagon box with the standard marker, and use the patrolman's flag as directed.
3. To at all times have available a rain coat or slicker, together with other necessary wearing apparel, that will permit working during light showers and rainy weather. (Excepting only heavy rains and storms.)
4. To cover entire earth or light surfaced sections immediately after each rain ceases even though it requires working certain Sundays or holidays.
5. To follow the instructions given especially as to earth roads. (After each rain the center of the road shall be smoothed up before any blade work is done on shoulders.)
6. To keep all ditches and culverts free and open.
7. To not take time off for shoeing horses, sharpening grader blades or other repair work on those days that weather conditions will permit working on the road surface.

8. To be responsible for and, at the County's expense, keep in repair all machinery and tools assigned to his section and furnish inventory of the same to the County at the end of the maintenance season.

Machinery or tools worn out or broken will be replaced by the County, and those lost must be replaced by the Patrolman.

9. To report violation of motor vehicle license law.

10. To make daily and monthly reports to the County Highway Commissioner as requested.

11. To have deducted from his monthly salary the sum of ------------------------------cents (------------c) per hour for the actual number of hours lost during the month.

12. To display red lantern on wagon or grader after dark, and display a red flag on his equipment at all times. Flag to be furnished by County.

13. To be courteous to the traveling public, giving information and assistance when necessary. No pay for such assistance is to be requested by the Patrolman.

14. To execute a bond in the sum of Five Hundred Dollars ($500.00) under the provisions of Section 289.16 of the Statutes.

And the said County in consideration of the full and complete performance of said duties by said Patrolman, hereby agrees to pay said Patrolman the sum of ------------------------------------ Dollars ($------------) per month during the maintenance season of 192----. Payment to be made at the same time and in the same manner as provided for the payment of the County Highway Commissioner.

No Patrolman's salary will be paid until the Maintenance Reports required of him shall have been received by the County Highway Commissioner.

Extra work ordered by the County and performed by the Patrolman outside of the maintenance season shall be paid for at the rate of ------------------------cents (--------------c) per hour.

The County reserves the right to discharge a Patrolman without notice, who has violated any provision of this contract.

IN WITNESS WHEREOF, The parties hereto have set their hands the date herein named.

APPROVED: ----------, 192---	----------------------- County
	Party of the First Part
-------------------------------	By ---------------------------
County Highway Commissioner.	-------------------------------

APPROVED: ----------, 192---	-------------------------------
-------------------------------	-------------------------------
Division Engineer, Wisconsin Highway Commission.	County Highway Committee.

	Patrolman. Party of the Second Part.

PATROLMAN'S BOND

KNOW ALL MEN BY THESE PRESENTS, That We-----------
------------------------------ of ------------------------------
County of-----------------------, State of---------------------,
as principal, and-------------------------- of-----------------
of the County of------------------------------, State of Wisconsin,
as surety, are held and firmly bound unto the County of ----------
--------------------, State of Wisconsin, in the penal sum of Five
Hundred Dollars ($500.00) lawful money of the United States, to be
paid to said -------------------------------------County, or to its
certain attorney, or assigns, for which sums of money, well and truly
to be paid, we bind ourselves, our heirs, executors and administrators,
jointly and severally, firmly by these presents.

SEALED with our seals and dated this------------------day of
--------------------------------------, A. D. 192----

The condition of this obligation is such that if the said bounden
principal--shall in all things
well and truly perform all the terms and conditions of the foregoing
contract, then this obligation is to be void, otherwise to be and remain
in full force and virtue.

Done in the presence of ----------------------(SEAL)
-------------------------------- ----------------------(SEAL)
-------------------------------- ----------------------(SEAL)

STATE OF WISCONSIN,)
County of------------------------ (

--being first duly
sworn, on oath says that he is worth the sum of-------------------
------------------------------Dollars in property within the state,
over and above all debts, liabilities and exemptions.

____

____

Subscribed and sworn to before me this-----------------day of
------------------------------------A. D. 192----

____

Notary Public, Justice of the Peace.
My Commission expires ----------------

FORM 301—1926

County of Buffalo

PATROLMAN'S MONTHLY REPORT

STATE TRUNK HIGHWAY MAINTENANCE

WISCONSIN HIGHWAY COMMISSION

Month of May 1926

Patrol Section No. 8

State Trunk Highway No. 35

									Hauling Materials					Material Hauled							Work Done in		
Day of Month	Blade Grader 1	Planer or Drag 2	Drainage 3	Removing Brush 4	Guard Rail, Culv. Brid'gs 5	Markers & Signs 6	Surface 7	Shoulders 8	Screenings, Sand or Clay 9	Gravel or Stone 10	Filling Joints on Paved Roads 11	Patching Surface Treated Roads 12	Total Hours Worked	Cubic Yards	Cost	Cost of Coal or Gasoline	Cost of Oil or Grease	Cost of Supplies and Repairs	Distance Traveled—Miles	Weather Conditions	Mile to Mile	Mile to Mile	Mile to Mile
1	10												10						18	cloudy	31	36	
2						Sunday																	
3	10												10						19	clear	34	38	
4				5	5								10						10	·	37	38	
5	5									5			10	4	.60				12	cloudy	33	35	
6		6	2										8						11	rain	31	36	
7	10												10						20	clear	34	38	
8	10												10						20	·	31	34	
9		5				Sunday							5						8	rain	31	35	
10	10												10						18	clear	33	38	
11	5							5					10						14	·	31	34	
12								5					5						6	Rain	34	36	
13								10					10						12	Clear	36	38	
14			2		8								10						6	..	35	36	
15										5			5	4	.60				6	rain	34	35	
16		10				Sunday							10						16	cloudy	31	38	
17	10												10						20	clear	31	38	
18	5						5						10						12	..	31	35	
19										10			10	8	120				8	..	34	35	
20			3										3						6	rain	35	36	
21	10												10						18	clear	31	38	
22	10												10						19	..	31	37	
23						Sunday																	
24	10												10						20	clear	31	38	
25	8						2						10						16	·	35	38	
26				4	6								10						4	·	35	36	
27		4	5										9						8	rain	31	35	
28	10												10						17	clear	31	38	
29	10												10						18	·	31	38	
30						Sunday																	
31								10					10						12	clear	35	38	
Tot'ls	133	25	12	9	19		7	30		20			255	16	240								
Amt																							

Remarks: On May 12 off 5 hours shoeing horses

Correct: ....

County Highway Commissioner.

Joe Doe

Patrolman.

WISCONSIN HIGHWAY COMMISSION

Madison, Wisconsin

REPORT OF ACCIDENT

ON STATE TRUNK HIGHWAY NO. _____, ____________COUNTY

1. Accident occurred the_________day of___________________, 192___, at______________o'clock _________ M.
2. Location: In mile No.___________, at or near___________________
   ____
   (Name some point such as R.R. Crossing, Bridge, School or Farm.)
3. How did accident occur?_______________________________________
   ____
   ____
   (State whether on R.R. Crossing, Straight Road, Curve, Right Angle Turn, Cross Road, Hill, Culvert or Bridge.)
4. Give license number of car or cars. ____________________________
   ____
   (Give year, state and everything on license plate.)
5. Was car or cars speeding? _____________________________________
6. If possible, give names and addresses of injured persons, if any, the nature of the injury, and the number of persons in the car or cars reported.
   ____
   ____
   ____
7. (a) Was the present condition of the highway in any way to blame for the accident? _______________. If so, in what way?
   ____
   ____
   (b) How can future accidents be prevented at this place?
   ____
   ____

Signed _________________________________
Patrolman, Sec. No. ____________________

NOTE:—Further information may be written on opposite side.

Form 200

DAILY REPORT—PATROLMAN NO.------------

Day--------------------Day--------------------192----

Item No.	Kind of Work		Hours	Work Done In		
				Mile to Mile	Mile to Mile	Mile to Mile
1	Blade Grader					
2	Planer or Drag					
3	Drainage					
4	Removing Brush					
5	Guard Rail, Culv., Bridge					
6	Markers and Signs					
7	Surface					
8	Shoulders					
9	Hauling	Screenings, Sand or Clay				
10	Material	Gravel or Stone				
11	Filling Joints on Paved Roads					
12	Patching Surface Treated Rds.					
Total						

EXPENDITURES

Material-----------------Cu. Yds. -- $----------------------$----------------------

Fuel: Coal or Gasoline--$----------------------

Oil or Grease--$----------------------

Repairs and Supplies

-----------------------------------$----------------------

-----------------------------------$----------------------$----------------------

Distance Traveled--Miles------------------

Weather Conditions--

Patrolman

Form 213 W. H. C.

PATROL SUPERINTENDENT'S MONTHLY REPORT

County of____________________

Distribution of Salary and Expenses of____________________ For____________________192____

Date	Total Hours Worked				Total Miles Run				Misc. Expenses				Date
	CHARGE TO				CHARGE TO				CHARGE TO				
	State Main Fund	County Main Fund	Other County Funds	Total	State Main Fund	County Main Fund	Other County Funds	Total	State Main Fund	County Main Fund	Other County Funds	Total	
1													1
2													2
3													3
4													4
5													5
6													6
7													7
8													8
9													9
10													10
11													11
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21													21
22													22
23													23
24													24
25													25
26													26
27													27
28													28
29													29
30													30
31													31
Total													Total

Rate Per Hour c	Allowance Per Mile c	

	CHARGE TO STATE MAIN FUND			CHARGE TO COUNTY MAIN FUND			CHARGE TO OTHER COUNTY FUNDS			TOTAL
Salary	Hrs.			Hrs.			Hrs.			
Mileage	Miles			Miles			Miles			
Expenses										
Total										

Certified as Correct.

County Clerk.

Approved

Division Engineer.

Signed

Patrol Superintendent.

County Highway Comissioner.

Form 207R—1925

Monthly Report of Expenditures

GENERAL MAINTENANCE

NOTE:—On this form report all expenditures for "Patrol Maintenance" and those expenditures incurred by gangs on work such as cleaning ditches, patching, tarring cracks, also for retreating of surface treated roads.

Do not report on this blank expenditures that are made for Betterments and Reconstruction.

Wisconsin Highway Commission

Month of______________________________

Pat. Sec.	Patrolman's Salary	Extra Help	Sand Stone Gravel	Filling Joints	Patching Surf. Treated Roads	Machinery Allowance	Coal, Gas, Oil, Grease	Supplies Repairs	Guard Rail	Culverts Bridges	Total
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
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26																						
27																						
28																						
29																						
30																						
31																						
32																						
33																						
34																						
35																						
Total																						

This report approved and recommended for payment

Certified to be a true and correct list of Maintenance Expenditures

Date ________ 192____ Division Engineer

________________ County Highway Commissioner

________________ County Clerk

NOTE: All items under "Surfacing Materials" and all others of $50.00 or more, except Patrolman's salary must be itemized in detail on reverse side of Report.

PATROL MAINTENANCE INSPECTION

County-------------------------------Pat. Sec. No. ----------
Patrolman------------------------ Address------------------------
S.T.H. No.------------Mile------------to Mile------------ Total length
S.T.H. No.------------Mile------------to Mile------------ ------Miles
Types: Conc.---------Mac.---------Grav.---------Earth-------Miscl.-------

Date		Classification						Activity in which Patrolman was engaged
Mo.	Day	Surface	Shoulders	Drainage	Structures	R. of W.	M. & S.	

Classify Conditions as Excellent (E), Good (G), Fair (F), or Poor (P). Use back of sheet for remarks or suggestions.

Form 293

Wisconsin Highway Commission

County of ____________________________
Job No.____________ Year____________

LOCATION OF GANG MAINTENANCE WORK

To the Wisconsin Highway Commission,
Madison, Wisconsin.

The undersigned County Highway Committee are of the opinion that a gang maintenance expenditure for the purpose of____________
____
should be located on that portion of State Trunk Highway No. ______ commencing at____ and ending at ____Total length of job__________________miles. Location of proposed work is shown on sketch below.

TOWN OF .... TOWN OF ....

6	5	4	3	2	1	6	5	4	3	2	1
7	8	9	10	11	12	7	8	9	10	11	12
18	17	16	15	14	13	18	17	16	15	14	13
19	20	21	22	23	24	19	20	21	22	23	24
30	29	28	27	26	25	30	29	28	27	26	25
31	32	33	34	35	36	31	32	33	34	35	36
6	5	4	3	2	1	6	5	4	3	2	1
7	8	9	10	11	12	7	8	9	10	11	12
18	17	16	15	14	13	18	17	16	15	14	13
19	20	21	22	23	24	19	20	21	22	23	24
30	29	28	27	26	25	30	29	28	27	26	25
31	32	33	34	35	36	31	32	33	34	35	36

TOWN OF........................ TOWN OF....................

Estimated Cost per mile for Grading________ $__________________

Estimated Cost per mile for Surfacing______ $__________________

Estimated Cost per mile for Culverts________ $__________________

Estimated Cost New Right-of-Way__________ $__________________

Estimated Total Cost Entire Job___________ $__________________

We will arrange to begin work about_______________________________
192_____and complete same not later than_________________________
192_____

_______________________________________County

____
County Highway Commissioner

____

____

____

____

____
County Highway Committee

Dated_____________________________________192____

Approved:
Wisconsin Highway Commission

By____
Division Engineer

By____
Maintenance Engineer

Dated_____________________________________192____

Form 208-R—1925

COUNTY OF________________________________
MONTH OF______________________________192____
WISCONSIN HIGHWAY COMMISSION

REPORT OF EXPENDITURES GANG MAINTENANCE

NOTE: On this form report expenditures incurred for BETTERMENTS and RECONSTRUCTION. By BETTERMENTS is meant work which puts roads in higher class, such as graveling an earth road or putting a surface treatment on a gravel or Macadam road for the first time, subsequent treatments of course should be placed on form No. 207R, GENERAL MAINTENANCE. By RECONSTRUCTION is meant the replacing or rebuilding the present surface or rebuilding existing structures, also where a gravel road is torn up and one replaced of same thickness, etc., this should be charged to RECONSTRUCTION. The DIVISION ENGINEER will supply the proper classification on Blank below.

Authority for Expenditure No.__________State Trunk Highway No.________
Patrol Section No.________________ Mile____________to Mile____________
Classification:_______________________________
Div. Engr. will fill in this space

ITEM	Cost	
Foreman's Wages		
Labor and Teams		
Stone		
Gravel		
Sand and Screenings		
Road Oil or Tar		
Coal or Gasoline		
Oil or Grease		
Machinery Allowance		
Supplies and Repairs		
Guard Rail		
Culverts and Bridges		
Material—Item Cost		
Total		

This report approved and recommended for payment.

____
Date 192 Division Engineer

Certified to be a true and correct statement of expenditures for Gang Maintenance.

____
County Clerk

____
County Highway Commissioner

Note: All items of $50.00 or more, except "Foreman's Wages" and "Labor and Teams" must be itemized on reverse side of report.

Form 252-R

County____________________ Sec. No.____________

Div. No.____________ S. T. H.________________

192____

Monthly Summary of

PATROL MAINTENANCE EXPENDITURES

W. H. C.

Mile____________to Mile____________

Month	Patrolman's Salary		Extra Help		Sand, Stone Gravel		Filling Joints		Patching Surf Treated Roads		Machinery Allowance		Coal, Gas, Oil, Grease		Supplies, Repairs		Guard Rail		Culverts Bridges		Total	
Jan.																						
Feb.																						
Mar.																						
Apr.																						
May																						
June																						
July																						
Aug.																						
Sept.																						
Oct.																						
Nov.																						
Dec.																						
Total																						

Total length____________Mi.

Cost per mile for patrol______________

Ave. cost per mile patrol and gang________________

Patrolman..............................

(Over)

County___________________________ Year 192____

Div. No.__________________

Monthly Summary of Expenditures for

GANG MAINTENANCE

W. H. C. S. T. H. Sec.______

	Reconstruction				Betterments		
Month	Authority No.	Amount		Month	Authority No.	Amount	
Jan.				Jan.			
Feb.				Feb.			
Mar.				Mar.			
Apr.				Apr.			
May				May			
June				June			
July				July			
Aug.				Aug.			
Sept.				Sept.			
Oct.				Oct.			
Nov.				Nov.			
Dec.				Dec.			
Total				Total			

Form No. 281 1M-5-23

County----------- 192 W. H. C.

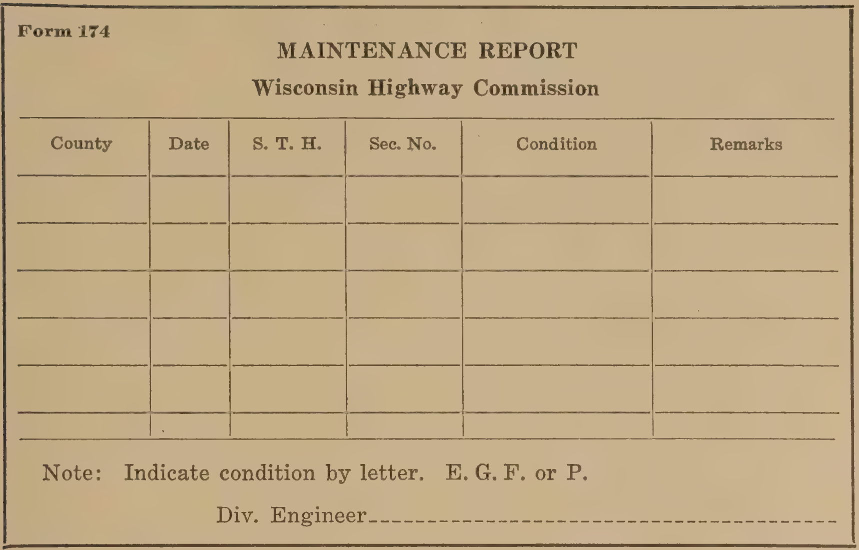
Div. No.----------- Summary of Expenditures Authority No.----------

GANG MAINTENANCE Am't authorized--------

Classification------

S. T. H. No.-------- Sec. No.--------- Mile------ to Mile------

Item	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Foreman													
Labor & Teams													
Stone													
Gravel													
Sand													
Oil & Tar													
Coal or Gasoline													
Oil or Grease													
Mach'y Allow.													
Supplies Repairs													
Guard Rail													
Culverts Bridges													
Materials													
Total													



Form 174

MAINTENANCE REPORT

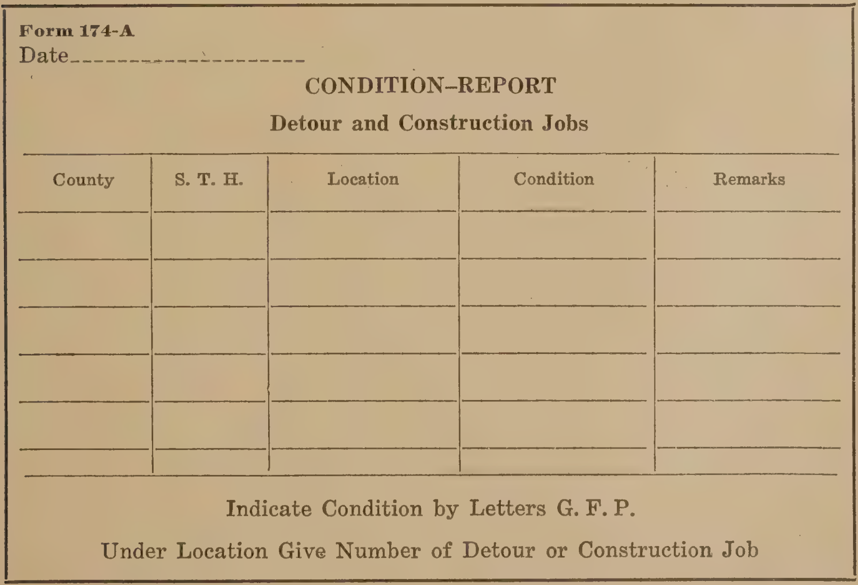
Wisconsin Highway Commission

County	Date	S. T. H.	Sec. No.	Condition	Remarks

Note: Indicate condition by letter. E. G. F. or P.

Div. Engineer______________________________________

This card used to report maintenance inspections.



Form 174-A
Date____________________

CONDITION–REPORT

Detour and Construction Jobs

County	S. T. H.	Location	Condition	Remarks

Indicate Condition by Letters G. F. P.

Under Location Give Number of Detour or Construction Job

This card used to report condition of detour or construction job.

Form No. 174-B

Date______________________

CONDITION-REPORT

Detour and Construction Jobs

County	S. T. H. No.	Const. Job or Det. No.	Condition	Date Started	Remarks

This card (red) used to report starting of detour or construction job.

Form No. 174-C

Date____________________

CONDITION-REPORT

Detour and Construction Jobs

County	S. T. H. No.	Const. Job or Det. No.	Condition	Date Removed	Remarks

This card (blue) used to report when detour is discontinued or job completed.

COUNTY OF ....

WISCONSIN HIGHWAY COMMISSION

CONDITION SURVEY REPORT ON STATE TRUNK HIGHWAY No ....

Between City Village of .... and City Village of .... Mile No. ....

	Tenths of Miles		1	2	3	4	5	6	7	8	9	10	Symbols
1	TYPE & WIDTH												⌂ school ⛪ church ♁ cemetery ☒ cheese factory ▭ other bldgs. △ camp site ⊕ spring ⚒ stone quarry ⚒ gravel pit ⊙ mail box ╪ cross road ╤ side road right ╨ side road left ⫲ R.R. Crossing Showing Angle of Intersection O Overhead G Grade U Underpass ↴ Turn Right ↱ Turn Left ↷ Curve Right ↶ Curve Left ⊖ Guard Rail (80'-B 60'-A etc.)
2	CONDITION												
3	SOIL												
4	DRAINAGE												
5	CULVERTS	WOOD											
6		STONE											
7		STEEL											
8		CONCRETE											
9		CULV. REQ'D											
10	BRIDGES	WOOD											
11		STONE											
12		STEEL											
13		CONCRETE											
14		BRIDGE REQ'D											
15	R.R. Crossings, Intersecting Roads and Landmarks												
16	Turns												
17	Hazardous Places												
18	Fed. Aid Proj.												
19	Gov't. Limits												
20	Const. Limits												
21	MARKERS	Erected											
		Required											
22	SIGNS	Erected											
		Required											
		Repaint											
23	GUARD RAIL	In Place											
		Required											
		Repaint											
		Repair											
24	POSTS	In Place											
		Required											

Remarks ....

....

....

....

.... 192...... Observer .... Mile No. ....

BRIDGE INFORMATION

TENTH	TYPE		Additional Information
	SPAN		
	CONDITION		
	ROADWAY		
	APPROX. DATE OF CONST.		
	PROBABLE LIFE		
TENTH	TYPE		
	SPAN		
	CONDITION		
	ROADWAY		
	APPROX. DATE OF CONST.		
	PROBABLE LIFE		
TENTH	TYPE		
	SPAN		
	CONDITION		
	ROADWAY		
	APPROX. DATE OF CONST.		
	PROBABLE LIFE		
TENTH	TYPE		
	SPAN		
	CONDITION		
	ROADWAY		
	APPROX. DATE OF CONST.		
	PROBABLE LIFE		
TENTH	TYPE		
	SPAN		
	CONDITION		
	ROADWAY		
	APPROX. DATE OF CONST		
	PROBABLE LIFE		

This is on back of report, page 153.

CHAPTER XIV

MISCELLANEOUS

Auto Registration. Statistics show that the automobile registration in Wisconsin has increased from 1500 in 1905 to 650,000 in 1926. It is difficult to predict what the future has in store but one thing is certain and that is there will be a steady increase from year to year. This will require more and better highways. It will require more extensive and intensive maintenance. It is a problem that the highway official must face and be able to solve. By looking into the future and anticipating the demands, the work may be well planned and the results will be adequate maintenance at minimum cost.

Traffic Counts, Tourist Business. Traffic counts taken during the past seven years show that traffic has more than trebled during that period. The percentage of horse-drawn vehicles has steadily decreased as may be noted in Table 8. Foreign or tourist traffic has multiplied by six, thus indicating that Wisconsin is a natural playground for thousands of out-of-state people. Statistics compiled in-

FIG. 2. Primitive transportation. If this outfit had the bows and a canvas top, it would be a typical "Covered Wagon." A few of these still travel our State Trunk Highways.

dicate that during the period from June 1 to September 1, there were over 9,000 foreign cars coming into Wisconsin daily. Information furnished by tourists on questionnaires handed to them further indicates that the average tourist car coming into Wisconsin makes a stay of approximately 8.5 days. Each car carries an average of 3.6 persons, and there is expended by each person an average of $2.82 per day. Each car travels an average of 586 miles during its stay in Wisconsin. From these figures it can be shown that the tourist business is an important factor in Wisconsin's development. It is estimated that during the season of 1925 approximately one hundred million dollars was expended by tourists in Wisconsin. This is approximately one-third of the dairy business of the state, which is the states leading industry. Adequate highway maintenance on both the state and county trunk highway systems has probably done more to bring tourists to Wisconsin than any other single factor. We have always had the beautiful lakes, streams and forests but good highways have made it possible for Wisconsin to "sell" these natural assets to the tourists.

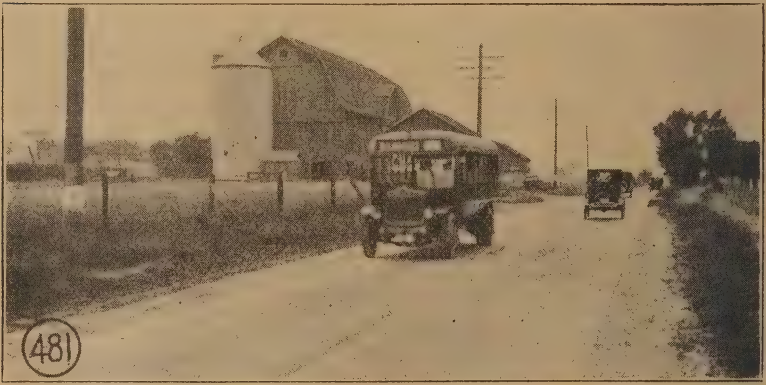


FIG. 3. Motor equipment on a high type road. Motor busses make regular daily trips between all important centers. Convenient transportation which can be utilized to advantage only over improved highways.

Safety on the Highways. The story of the vast use of motor vehicles by the people of the United States and the improvement of the highways over which these motor vehicles are being operated has in the main been a pleasant

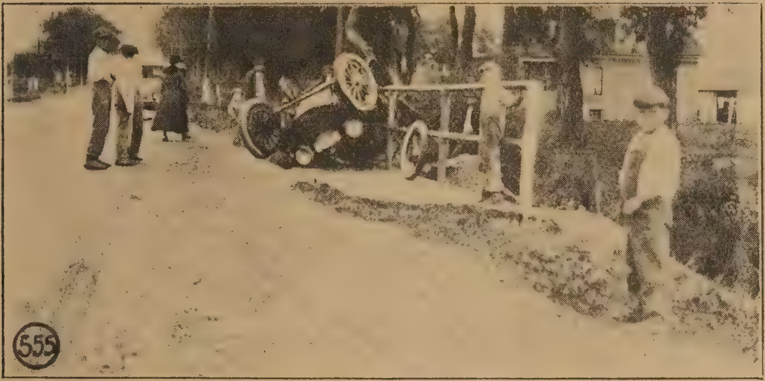


FIG. 1. Wrong side up on the wrong side of the road. A smooth straight, level road, at least 30 feet wide. No apparent reason for the accident.

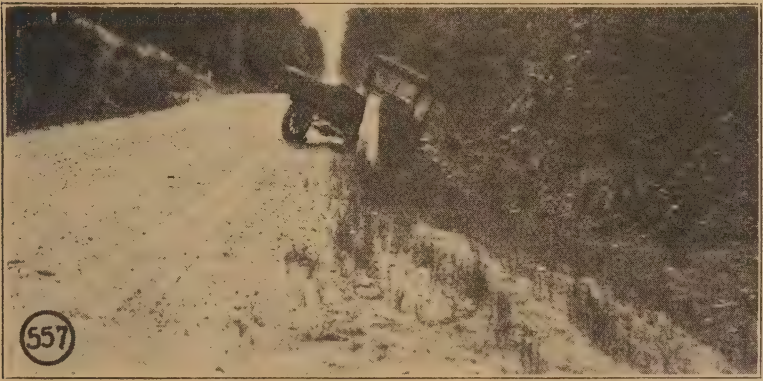
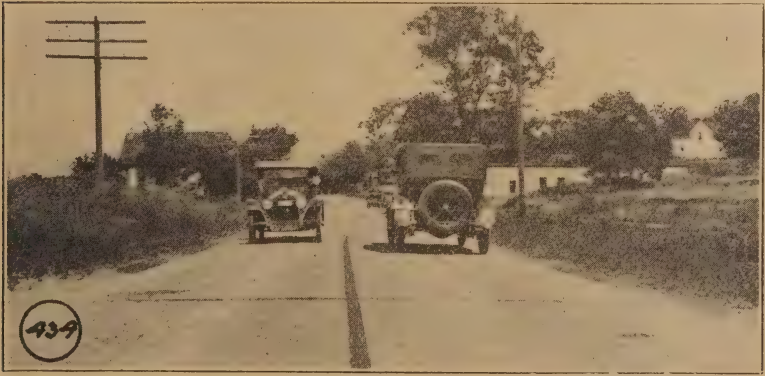


FIG. 2. Another accident on a wide, smooth, straight road. Most accidents occur where there is no apparent reason. In most cases due to careless driving.



Method of driving traffic on a concrete road, S. T. H. 12 and 13 Dane County.

one. The development of motor vehicle transportation has brought with it a vast increase in comfort and convenience. It has made remote farms readily accessible to important centers of population and brought the residents of congested centers out into the free air of the open country. It has made possible the increased use of our educational facilities and permitted the medical practitioner to get to the bedside of his distant patient in a minimum of time. On the whole the use of the motor vehicle over improved highways has been one of the greatest blessings to mankind, but the story has some unpleasant features.

The increased use of motor vehicles brought with it a very large increase in the number of accidents on the highways and these have resulted in great suffering. One of the greatest problems facing the American public today is that of reducing the number of these accidents to a minimum. The large majority of these accidents is avoidable and many of these avoidable accidents are due to negligence that is on the verge of being criminal. It is only when we get an aroused public conscience that the number of motor vehicle accidents will be reduced to the minimum. The State Highway Commission has been endeavoring during the past three or four years to secure records of the number and character of accidents occurring on the state trunk highways. Table X shows those accidents reported up to the end of 1925.

It is the public duty of every highway worker, whether he be a patrolman, county highway commissioner, or engineer, to promote safety on the highways. He can best do this by setting a good example for others to follow. The patrolman in many cases can reduce the number of accidents occurring on the highways through the condition of the surface by properly maintaining the surface. For the motorist, the following is suggested as the ten commandments for safe driving:

1. Keep to the right.
2. Drive slowly on wet pavement and on loose gravel.
3. Give the vehicle passing you either way half the road.

   Park your car where it will not obstruct or impede traffic.

4. Look out for and heed traffic signs; give proper signal to car following you.

5. Keep your car under control. Many accidents occur because of reckless driving and speeding.

6. Beware of railroad crossings, especially grade crossings. Practically 15 per cent of all fatal accidents occur at grade crossings.

7. If you are an inexperienced driver, avoid heavy traffic. Get your experience where there is less danger of getting hurt or endangering others.

8. Do not park your car in an alley, street or highway without a light to warn drivers. A red tail light and a single white light in the front on the side nearest to traffic is sufficient.

9. Slow down as you approach street, highway, or railroad crossings unless the view is clear or you can plainly see that no vehicle or train is approaching the intersection from either direction.

10. Never pass a vehicle that is going in the same direction at a crossing, on a curve, or when approaching a hill. Be sure the road is clear before you drive on the left side to pass another vehicle or obstruction.

If the above suggestions are followed, very few accidents will occur on the highways.

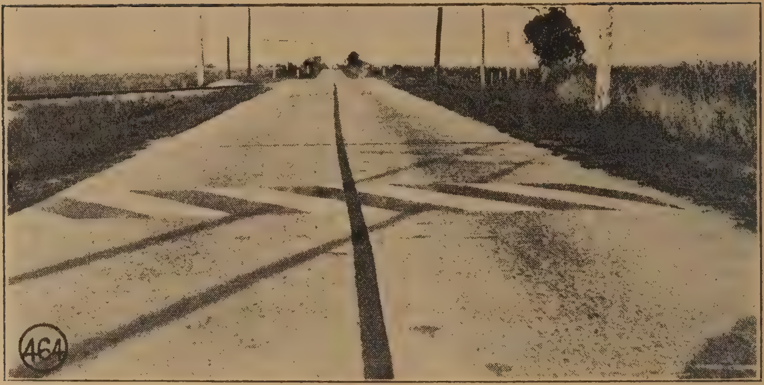


FIG. 1. Protective painting at railroad grade crossing. Applicable only to paved roads. Should be placed to warn the driver only when approaching a crossing. Walworth County.

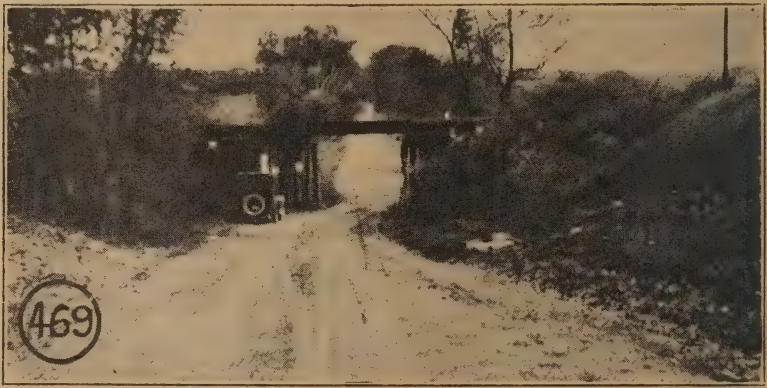


FIG. 2. Subway before improvement, opening at right angles to the railroad center line, causing an abrupt turn in the road immediately under the subway. Walworth County.

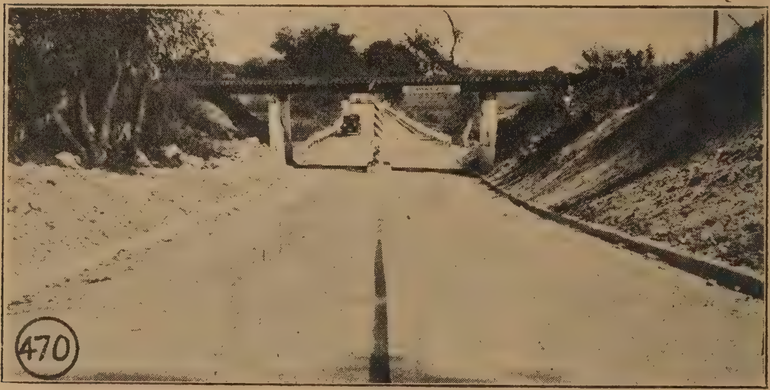


FIG. 3. Same subway after improvement. A clear view and a clear roadway of 14 feet on each side. Note the reflecting signals in the center. In spite of this, a driver drove into the center support. He thought vehicles should straddle the center line mark.

CHAPTER XV

CONCLUSIONS

Systematic Maintenance. Highway maintenance is one of the important factors in our present day transportation system; in fact, one of the few things with regard to highway work on which all opinions seem to be agreed is that large expenditures of money for construction, however well done, are a waste of public funds unless followed by systematic maintenance. The first year of maintenance on the State Trunk Highway system in Wisconsin was 1918. Since that time the system has been much improved by construction with both state and federal aid and by maintenance operations, so that now travelers in any part of the state can start on a journey to any other part and drive directly to their destinations over roads which are in a majority of instances excellent, without the necessity of making any inquiry as to routes.

New Methods. The public as a whole is well pleased, but there is ever a constant desire on its part for more and more service, and in order to meet these increased demands, the highway organization must function more efficiently than it has in the past. New ideas and methods must be developed to keep pace with the rapid growth of highway transportation.

Future Requirements. One need only look back a few years to note the progress already made, but it would tax the imagination to prophesy what might be expected in the future. As years progress our modern civilization becomes more and more involved. Better sanitation, better schools, more comforts, and improved communications of all kinds are among some of the things demanded, and if we may judge the future by what has happened in the past, it is safe to say that the public will get what it wants if it is willing to pay for it. That it is willing to pay is evidenced by the fact that the price or cost of work is soon forgotten provided that if in the expenditure of the funds, satisfactory service has been rendered.

Patrolman's Part, Supervision. As previously stated, the maintenance of our highways is one of the important factors in rendering transportation service. The success of the work depends very largely on the patrolmen who form the framework or backbone of the maintenance organization. The great bulk of the patrolman's time is spent without any direct supervision. As a tribute to the patrolmen and their work, it may be said that in a great majority of cases their work has been very satisfactory and has contributed largely to the success of patrol maintenance in Wisconsin. It is true that in some cases patrolmen have been found wanting, but this condition is bound to exist in any large organization. This may be due in some cases to the patrolman himself, and in some instances it is due to the lack of proper supervision by the county commissioner or his assistants. It must be remembered that the principal object sought is to render traffic service to the public. This can best be done by planning and efficiently supervising the work which we have to do. There must be thorough cooperation between the patrolman and the county commissioner and between the county department and the state department. This is the end toward which we should strive, and by accomplishing this purpose we will at the same time give the road users real highway service.

It is hoped that in the methods and practices outlined, the patrolmen or maintenance men will find something to help better their work. They may not agree with all the statements therein, as conditions are bound to vary throughout the state, but in a general way, the methods outlined are those which have been used successfully in this and other states.

Reminders to Patrolmen and Maintenance Men. As final instructions to the patrolmen and maintenance men, the following reminders are suggested as a code to follow in their daily work.

1. Be punctual; be on the job 10 hrs. each day (7:00 A. M. to 6:00 P. M.) Try to "keep up" rather than to "catch up".
2. Be interested in your work—enthusiasm makes work easy. Be resourceful—work out new and better ideas whenever possible.
3. Be courteous at all times. The user of the road is paying the bill; he demands service. Make it easy for him to get over your section. Refrain from arguments. If you cannot adjust the complaint refer it to your immediate superior.
4. Do not leave loose material on travelled way; likewise never obstruct traffic by parking equipment on travelled way. If necessary to stop for handwork, park equipment out of the path of traffic. Give them the right of way whenever possible without interfering with your work.
5. Remember there is a proper time for doing all work. Plan ahead and by so doing you will get the maximum results with minimum effort.
6. Use the red flag at all times, and after dark when on the highway always have a red lantern on your equipment. Use the "off road" flag when leaving your section. This saves time for Commissioner or Patrol Superintendent and protects you from unjust criticism.
7. You are responsible for the equipment turned over to you. Keep it in good repair. Account for it at the end of the season.
8. Improve those features on your section which may be a source of danger. Always clean flangeway at railroad grade crossing after each trip across.
9. Work the poorest parts of your section first. Make the first work in the spring and the last work in the

fall consist of cleaning the inlets and outlets of all culverts, ditches, and drain tile.

10. Be familiar with highway and automobile laws and rules of the road. Report violations to the proper officials. Report owners of cars not displaying proper number plates to Secretary of State, Madison.

11. Fill out and send in your reports promptly. Always wear your patrolman's badge on your hat.

12. Remember that the road that you will be proud of will take but little more effort on your part than the road you must apologize for. It is doing the little things that seem hardly worth while that will make the difference between an excellent and an ordinary road.

13. Remember that in all successful and efficient organizations, discipline is the controlling and regulating force. Therefore, always be ready to take instructions from your superiors.

14. Keep your temper whether the other fellow does or not. In short—make the fulfilling of your contract a pleasant duty and not a painful obligation.

To The County Highway Departments:

Cooperation. The success or failure of patrol maintenance rests to a great degree upon the individual patrolman. If he is intelligent, conscientious, and honest, and a good worker and follows rigidly the instructions given him, he will render the service that is expected of him. In order that he do this, however, each County Highway Commissioner must insist upon every patrolman giving just returns for the salary he is paid. The Commissioner must know when the patrolman has done a day's work. He should visit him often enough to know that the work is done at the proper time and in the proper manner. He should not hesitate to discharge the incompetent or inefficient men, for every poor patrolman is a weak link in the chain of successful maintenance. Representatives of the Highway Commission will visit the several counties often enough to know whether or not the maintenance work is being performed properly and adequately. There is no question but what the best of results will be assured if there be thorough cooperation between the County and State, and when this condition exists it may be truly said that "Traffic is served in Wisconsin".

CHAPTER XVI

TABLES

This chapter includes several tables showing statistics on maintenance allotments, expenditures, and various other data of interest. Tables 1, 1-A and 1-B show the maintenance allotments to the counties for the maintenance of the State Trunk Highway System from 1918 to 1925, inclusive.

Tables 2, 2-A, 2-B, 2-C, 2-D, 2-E, 2-F, 2-G and 2-H, inclusive, show the total maintenance expenditures by counties by years from 1918 to 1925, inclusive.

Table 3 shows the maintenance expenditures per mile for different types of surfacing from 1918 to 1925, inclusive.

Table 3-A shows a summary of maintenance expenditures by years.

Table 4. This table shows the allotment to towns, villages and cities for roads and streets, exclusive of the State Trunk Highways, County Trunk Highway and connecting streets in cities. This allotment is made in accordance with the new highway law passed by the legislature of 1925.

Tables 5 and 5-A show a classification of the State Trunk Highways by counties by types, from 1918 to the end of 1925. Table 5-B shows the same classification by divisions for the year ending December 31, 1925.

Table 6. This table shows the state aid allotment to the counties for construction for all years up to 1925, inclusive.

Table 6-A shows the allotment of federal aid, state aid and for county trunk improvements under Section 20.49 for the fiscal year ending June 30, 1926.

Table 7 shows a summary of motor vehicle registration by years from 1905 to 1925, inclusive.

Table 7-A shows the motor vehicle registration by counties for the years 1914, 1918, 1922 and 1923. It also shows the percentage owned in each county.

Table 7-B shows the motor vehicle registration by classes for the years 1924 and 1925.

Table 8. This shows a summary of the traffic counts taken by years 1919 to 1925, inclusive.

Table 9. This shows a summary of the State Line traffic counts of tourist cars taken during the season of 1925.

Table 10 shows a summary of accidents occurring on the State Trunk Highway System from May, 1922, to the end of 1925.

Table 11. This table is a record of the county trunk highways maintained by the counties by years from 1918 to 1925, inclusive.

Table 12. This table shows the cubic yards of material required for various widths and depths of gravel or stone surfacing.

Table 13. This table shows the amount of cement, sand and stone required to make one cubic yard of compacted mortar or concrete of various proportions.

Table 14. This is a list of the State Trunk Highways by numbers, giving the starting point and terminus of each.

Table 15. This gives a list of the counties and the State Trunk Highways which pass through them.

TABLE I—MAINTENANCE FUNDS ALLOTTED TO COUNTIES YEARS 1918 TO 1923 INCLUSIVE

This table shows the distribution of the motor vehicle registration fees appropriated for the Maintenance of the State Trunk Highway System. For 1924 and 1925 allotments, see Tables 1a and 1b.

Year—	1918	1919	1920	1921	1922	1923	Totals
Adams	$ 14,912.60	$ 15,310.65	$ 14,123.97	$ 18,654.29	$ 22,222.75	$ 24,356.29	$ 109,580.55
Ashland	17,056.82	17,512.09	17,611.26	24,557.50	26,067.25	30,343.57	133,148.49
Barron	18,347.77	18,837.51	28,930.00	28,930.00	29,612.00	37,688.00	162,345.28
Bayfield	19,366.42	19,883.34	23,472.38	28,421.26	41,269.25	44,058.49	176,471.14
Brown	14,142.06	14,519.37	34,512.50	34,512.50	35,249.50	44,863.00	177,798.93
Buffalo	20,026.02	20,560.54	23,612.23	30,332.50	30,349.00	35,366.14	160,246.43
Burnett	7,949.49	8,161.68	12,977.92	18,001.88	19,052.00	21,705.31	87,848.28
Calumet	12,738.14	13,078.15	21,341.76	23,072.50	23,248.50	29,306.63	122,785.68
Chippewa	17,411.82	17,876.57	30,530.16	32,010.00	33,627.00	41,083.00	172,538.55
Clark	16,243.91	16,677.49	30,796.18	31,240.00	31,163.00	39,662.00	165,782.58
Columbia	19,816.24	20,345.16	35,708.36	40,755.00	42,413.25	53,042.14	212,080.15
Crawford	13,302.94	13,658.02	18,794.07	24,227.50	24,348.50	28,949.60	123,280.63
Dane	31,777.80	32,626.00	58,932.50	57,750.00	56,025.75	71,305.50	308,417.55
Dodge	19,190.94	19,703.17	46,337.50	47,025.00	46,557.50	59,255.00	238,069.11
Door	8,235.92	8,455.74	17,463.52	17,545.00	17,572.50	22,365.00	91,637.68
Douglas	12,586.86	12,922.83	19,662.50	23,017.50	26,991.25	34,352.50	129,533.44
Dunn	8,629.26	8,859.59	23,017.50	23,017.50	31.108.00	38,662.14	133,293.99
Eau Claire	16,772.39	17,220.08	24,062.50	24,062.60	24,098.25	30,670.50	136,886.22
Florence	6,928.83	7,113.77	5,573.40	7,359.83	9,432.50	10,240.72	46,649.05
Fond du Lac	16,982.18	17,435.46	40,837.50	40,837.50	40,914.50	52,073.00	209,080.14
Forest	12,796.65	13,138.21	12,085.02	15,784.87	29,441.50	31,188.86	114,435.11
Grant	22,422.37	23,020.85	50,879.99	53,597.50	53,553.50	68,159.00	271,633.21
Green	11,394.74	11,698.89	20,652.50	20.652.50	21,293.25	27,100.50	112,792.38
Green Lake	9,432.08	9,683.84	15,496.94	15,757.50	15,482.50	19,705.00	85,557.86
Iowa	13,337.24	13,693.23	22,395.81	22,742.50	22,563.75	28,717.50	123,450.03
Iron	10,844.07	11,133.52	11,651.71	14,575.80	19,593.75	21,068.10	88,866.95
Jackson	13,232.34	13,585.53	21,654.84	27,637.50	27,571.50	33,172.57	136,854.28
Jefferson	15,963.53	16,389.62	37,455.00	37,730.00	37,881.25	48,212.50	193,631.90
Juneau	17,210.11	17,669.48	18,867.50	23,705.00	23,903.00	30,245.97	131,601.06
Kenosha	7,195.08	7,387.13	14,905.00	14,905.00	14,850.00	18,900.00	78,142.21
Kewaunee	10,553.60	10,835.29	16,633.65	19,057.50	18,991.50	23,758.71	99,830.25
La Crosse	9,879.88	10,143.59	23,045.00	23,045.00	23,012.00	29,288.00	118,413.47
Lafayette	13,466.32	13,825.76	26,967.82	30,827.50	30,489.25	37,258.93	152,835.58
Langlade	6,491.11	6,664.37	16,173.44	20,432.50	23,952.50	28,189.15	101,903.07
Lincoln	8,342.83	8,565.52	14,091.39	16,335.00	24,337.50	29,234.88	100,907.12

Manitowoc	15,269.64	15,677.21	25,987.50	25,987.50	26,287.25	33,456.50	142,665.60
Marathon	21,716.37	22,296.02	38,582.50	38,582.50	38,175.50	48,587.00	207,939.89
Marinette	12,344.81	12,674.31	20,989.40	26,840.00	25,907.75	32,835.66	131,591.93
Marquette	8,268.20	8,488.88	11,819.03	13,997.50	13,816.00	17,214.98	73,604.59
Milwaukee	13,994.81	14,368.36	21,175.00	21,175.00	21,692.00	27,608.00	120,013.17
Monroe	15,154.67	15,559.17	29,485.49	34,237.50	33,203.50	41,580.76	169,221.09
Oconto	13,635.76	13,999.73	25,924.02	39,737.50	40,909.00	46,950.14	181,156.15
Oneida	23,414.80	24,039.77	24,772.23	32,102.97	42,383.00	46,179.91	192,892.68
Outagamie	10,168.33	10,439.74	28,902.50	28,902.50	28,861.25	36,732.50	144,006.82
Ozaukee	6,959.08	7,144.83	12,842.50	12,842.50	16,313.00	20,762.00	76,863.91
Pepin	5,426.06	5,570.89	8,193.75	9,597.50	9,586.50	11,924.06	50,298.76
Pierce	10,775.48	11,063.10	23,706.29	24,282.50	24,048.75	30,607.50	124,483.62
Polk	14,527.34	14,915.10	24,691.53	24,695.00	24,488.75	31,167.50	134,485.22
Portage	15,683.15	16,101.75	28,123.81	32,615.00	34,562.00	42,148.65	169,234.36
Price	16,790.55	17,238.72	17,394.24	23,985.92	35,755.50	39,140.62	150,305.55
Racine	13,274.70	13,629.03	19,662.50	19,662.50	19,673.50	25,039.00	110,941.23
Richland	15,469.34	15,882.24	22,714.39	24,310.00	24,271.50	30,355.32	133,002.79
Rock	16,280.21	16,714.76	39,050.00	39,050.00	38,137.00	48,538.00	197,769.97
Rusk	15,184.92	15,590.23	15,742.85	22,840.21	23,485.00	26,892.31	119,735.52
St. Croix	13,891.94	14,262.74	28,487.91	33,715.00	34,284.25	41,768.14	166,409.98
Sauk	21,492.47	22,066.14	36,426.07	37,757.50	37,578.75	47,827.50	203,148.43
Sawyer	12,332.71	12,661.89	13,379.71	15,985.17	25,289.00	28,463.14	108,111.62
Shawano*	20,655.37	21,206.69	31,274.57	37,977.50	37,796.00	45,224.21	194,134.34
Sheboygan	13,855.63	14,225.46	29,837.50	29,837.50	29,040.00	36,960.00	153,756.09
Taylor	5,349.42	5,492.20	14,943.65	21,627.01	22,275.00	25,477.82	95,165.10
Trempealeau	18,410.30	18,901.70	30,557.77	34,760.00	34,707.75	42,709.86	180,047.38
Vernon	12,461.80	12,794.42	32,168.84	35,860.00	35,048.75	44,365.30	172,699.11
Vilas	12,074.51	12,396.80	12.312.81	15,182.35	25,297.25	27,092.10	104,355.82
Walworth	18,166.23	18,651.12	38,111.72	39,160.00	39,435.00	50,190.00	203,714.07
Washburn	15,259.55	15,666.85	14,927.42	19,898.20	23,798.50	30,272.10	119,822.62
Washington	12,619.14	12,955.96	20,212.50	20,212.50	19,846.75	25,259.50	111,106.35
Waukesha	14,484.98	14,871.61	43,505.00	43,505.00	45,067.00	57,358.00	218,791.59
Waupaca	16,453.69	16,892.86	37,510.00	37,510.00	37,892.25	48,226.50	194,485.30
Waushara	19,917.10	20,448.72	25,719.20	32,862.50	32,056.75	37,213.73	168,218.00
Winnebago	7,876.87	8,087.12	21,560.00	21,560.00	21,466.50	27,321.00	107,871.49
Wood	13,718.47	14,084.64	23,017.50	23,017.50	23,397.00	29,778.00	127,013.11
Menominee Indian Res.*			5,034.98	7,040.00	7,040.00	8,423.60	27,538.58
Totals	$1,008,338.76	$1,035,252.80	$1,750,000.00	$1,935,027.26	$2,051,112.25	$2,515,199.11	$10,294,930.18

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* Menominee Indian Reservation is part of Shawano Co. but is treated separately.

TABLE Ia.—MAINTENANCE FUNDS ALLOTTED TO COUNTIES FOR THE YEAR 1924

Maintenance funds allotted to counties for the year 1924, showing the distribution of the motor vehicle registration fees appropriated for the Maintenance of the State Trunk Highway System, connecting streets in cities, and swing or lift bridges located on the system in cities or villages (Sec. 20.04(3)(h))

County	State Trunk Highway System		Connecting Streets In Cities	
	Maintained Mileage	Amount Allotted	Mileage	Amount Allotted
Adams	94.60	$28,380.00		
Ashland	119.00	35,700.00	3.60	$1,080.00
Barron	135.30	40,590.00	2.00	600.00
Bayfield	160.70	48,210.00	1.00	300.00
Brown	159.87	47,961.00	8.83	2,649.00
Buffalo	136.24	40,872.00		
Burnett	94.40	28,320.00		
Calumet	100.14	30,042.00		
Chippewa	173.40	52,020.00	3.70	1,110.00
Clark	164.33	49,299.00		
Columbia	218.68	65,604.00	2.30	690.00
Crawford	126.60	37,980.00	2.10	630.00
Dane	310.00	93,000.00	13.54	4,062.00
Dodge	238.90	71,670.00	7.81	2,343.00
Door	90.83	27,249.00	1.12	336.00
Douglas	134.40	40,320.00	12.80	3,840.00
Dunn	172.18	51,654.00	2.30	690.00
Eau Claire	123.66	37,098.00	6.34	1,902.00
Florence	42.60	12,780.00		
Fond du Lac	181.20	54,360.00	10.50	3,150.00
Forest	135.20	40,560.00		
Grant	227.81	68,343.00	2.57	771.00
Green	126.60	37,980.00	3.70	1,110.00
Green Lake	70.65	21,195.00	2.00	600.00
Iowa	150.87	45,261.00	1.34	402.00
Iron	80.00	24,000.00	2.50	750.00
Jackson	166.72	50,016.00		
Jefferson	170.56	51,168.00	8.66	2,598.00
Juneau	125.50	37,650.00		
Kenosha	78.20	23,460.00	5.20	1,560.00
Kewaunee	83.67	25,101.00		
La Crosse	109.40	32,820.00	7.96	2,388.00
Lafayette	129.68	38,904.00		
Langlade	121.05	36,315.00	3.20	960.00
Lincoln	148.95	44,685.00	6.27	1,881.00
Manitowoc	181.29	54,387.00	4.81	1,443.00
Marathon	212.90	63,870.00	5.05	1,515.00
Marinette	132.23	39,669.00	2.59	777.00
Marquette	65.75	19,725.00		
Milwaukee	114.40	34,320.00	32.10	9,630.00
Monroe	172.33	51,699.00	4.42	1,326.00
Oconto	148.34	44,502.00	2.86	858.00
Oneida	175.05	52,515.00	4.45	1,335.00
Outagamie	162.63	48,789.00	8.84	2,652.00
Ozaukee	79.80	23,940.00	2.00	600.00
Pepin	66.81	20,043.00		
Pierce	157.85	47,355.00		
Polk	144.00	43,200.00		
Portage	143.50	43,050.00	4.05	1,215.00
Price	148.65	44,595.00	.70	210.00

TABLE Ia—Cont.

County	State Trunk Highway System		Connecting Streets In Cities	
	Maintained Mileage	Amount Allotted	Mileage	Amount Allotted
Racine	123.10	$36,930.00	11.30	$3,390.00
Richland	129.39	38,817.00	2.18	654.00
Rock	192.50	57,750.00	14.12	4,236.00
Rusk	108.10	32,430.00	1.70	510.00
St. Croix	172.90	51,870.00	1.74	522.00
Sauk	218.57	65,571.00	7.10	2,130.00
Sawyer	139.20	41,760.00		
Shawano	151.46	45,438.00	2.30	690.00
Sheboygan	157.20	47,160.00	7.00	2,100.00
Taylor	114.43	34,329.00		
Trempealeau	171.56	51,468.00		
Vernon	184.24	55,272.00	2.50	750.00
Vilas	99.75	29,925.00		
Walworth	152.70	45,810.00	5.80	1,740.00
Washburn	124.10	37,230.00	3.80	1,140.00
Washington	136.30	40,890.00		
Waukesha	214.50	64,350.00	6.30	1,890.00
Waupaca	174.40	52,320.00	4.70	1,410.00
Waushara	124.15	37,245.00		
Winnebago	126.46	37,938.00	11.12	3,336.00
Wood	140.55	42,165.00	7.25	2,175.00
Menominee Indian Reservation	44.75	13,425.00		
Totals	10,207.73	$3,062,319.00	282.12	$ 84,636.00

SWING OR LIFT BRIDGES

County	City or Village	Name of Bridge	Name of Stream	Length of Moveable Part	Amount Allotted
Columbia	C Portage	Portage Bridge	Fox River Canal	109.5	$2,000
Sauk	V Sauk City	Sauk City Bridge	Wisconsin River	78.0	500
Sauk	V Prairie du Sac	Prairie du Sac Bridge	Wisconsin River	97.0	500
Brown	V Wrightstown	Wrightstown Bridge	Fox River	145.5	2,000
Kewaunee	C Kewaunee	Kewaunee Bridge	Kewaunee River	181.0	3,000
Outagamie	V Shiocton	Shiocton Bridge	Wolf River	124.0	2,000
Winnebago	V Omro	Omro Bridge	Fox River	79.0	1,000
Winnebago	V Winneconne	Winneconne Bridge	Wolf River	165.0	3,000
Green Lake	C Princeton	Princeton Bridge	Fox River	162.0	3,000
Waupaca	V Fremont	Fremont Bridge	Wolf River	78.0	1,000
La Crosse	C La Crosse	La Crosse Bridge	Mississippi River	445.0	5,000
Total					$23,000

TABLE Ib.— SHOWING MAINTENANCE FUNDS ALLOTTED TO COUNTIES AND CITIES FOR THE YEAR 1925

Funds allotted to counties for maintenance of state trunk highways, 1925		
County	Maintained Mileage	Amount Allotted
Adams	96.50	$28,950
Ashland	119.00	35,700
Barron	134.70	40,410
Bayfield	159.00	47,700
Brown	159.57	47,871
Buffalo	136.24	40,872
Burnett	93.00	27,900
Calumet	100.14	30,042
Chippewa	172.65	51,795
Clark	163.31	48,993
Columbia	218.68	65,604
Crawford	127.16	38,148
Dane	310.00	93,000
Dodge	238.90	71,670
Door	90.83	27,249
Douglas	134.60	40,380
Dunn	171.34	51,402
Eau Claire	123.66	37,098
Florence	45.10	13,530
Fond du Lac	181.20	54,360
Forest	132.70	39,810
Grant	229.71	68,913
Green	126.60	37,980
Green Lake	70.65	21,195
Iowa	151.39	45,417
Iron	80.00	24,000
Jackson	166.72	50,016
Jefferson	170.56	51,168
Juneau	125.50	37,650
Kenosha	78.20	23,460
Kewaunee	83.67	25,101
La Crosse	109.40	32,820
Lafayette	129.43	38,829
Langlade	121.05	36,315
Lincoln	148.95	44,685
Manitowoc	181.29	54,387
Marathon	212.90	63,870
Marinette	132.23	39,669
Marquette	65.75	19,725
Milwaukee	114.40	34,320
Monroe	172.33	51,699
Oconto	149.29	44,787
Oneida	175.05	52,515
Outagamie	162.63	48,789
Ozaukee	79.80	23,940
Pepin	66.68	20,004
Pierce	157.80	47,340
Polk	144.20	43,260
Portage	141.60	42,480
Price	148.65	44,595
Racine	123.10	36,930
Richland	130.92	39,276
Rock	192.50	57,750
Rusk	108.00	32,400
St. Croix	171.17	51,351
Sauk	218.57	65,571
Sawyer	135.00	40,500
Shawano	150.46	45,138
Sheboygan	157.20	47,160
Taylor	113.88	34,164

Funds allotted to cities for maintenance of connecting streets, 1925			
County	City	Mileage	Amount Allotted
Ashland	Ashland	4.00	$ 1,200
Barron	Rice Lake	2.00	600
Bayfield	Washburn	1.00	300
Brown	De Pere	2.84	852
	Green Bay	6.30	1,890
Chippewa	Stanley	.70	210
	Chippewa Falls	3.97	1,191
Columbia	Portage	2.30	690
Crawford	Prairie du Chien	2.10	630
Dane	Madison	11.89	3,567
	Stoughton	1.65	495
Dodge	Beaver Dam	3.31	993
	Mayville	1.89	567
	Watertown	.40	120
	Waupun	2.21	663
Door	Sturgeon Bay	1.12	336
Douglas	Superior	13.00	3,900
Dunn	Menomonie	3.17	951
Eau Claire	Eau Claire	6.39	1,917
Fond du Lac	Fond du Lac	6.50	1,950
	Ripon	2.00	600
	Waupun	2.00	600
Grant	Platteville	2.57	771
Green	Monroe	3.70	1,110
Green Lake	Berlin	2.00	600
Iowa	Mineral Point	1.34	402
Iron	Hurley	2.50	750
Jefferson	Ft. Atkinson	2.93	879
	Jefferson	2.17	651
	Watertown	3.56	1,068
Kenosha	Kenosha	5.20	1,560
La Crosse	La Crosse	7.95	2,385
Langlade	Antigo	3.20	960
Lincoln	Merrill	4.82	1,446
	Tomahawk	1.45	435
Manitowoc	Manitowoc	2.54	762
	Two Rivers	2.27	681
Marathon	Wausau	5.05	1,515
Marinette	Marinette	2.59	777
Milwaukee	S. Milwaukee	2.10	630
	West Allis	4.20	1,260
	Milwaukee	25.80	7,740
Monroe	Sparta	2.42	726
	Tomah	2.00	600
Oconto	Oconto	2.91	873
Oneida	Rhinelander	4.45	1,335
Outagamie	Appleton	6.16	1,848
	Kaukauna	2.04	612
	New London	.64	192
Ozaukee	Pt. Washington	2.00	600
Portage	Stevens Point	4.05	1,215
Price	Park Falls	.70	210
Racine	Burlington	2.40	720
	Racine	8.90	2,670
Richland	Richland Center	2.18	654
Rock	Beloit	4.72	1,416
	Edgerton	3.65	1,095
	Janesville	5.75	1,725
Rusk	Ladysmith	1.70	510
St. Croix	Hudson	1.80	540
Sauk	Baraboo	4.57	1,371

TABLE Ib.—SHOWING MAINTENANCE FUNDS ALLOTTED TO COUNTIES AND CITIES FOR THE YEAR 1925—Continued

Funds alloted to counties for maintenance of state trunk highways, 1925		
County	Maintained Mileage	Amount Allotted
Trempealeau	171.56	$51,468
Vernon	186.64	55,992
Vilas	99.75	29,925
Walworth	152.70	45,810
Washburn	124.30	37,290
Washington	136.30	40,890
Waukesha	214.50	64,350
Waupaca	174.40	52,320
Waushara	124.15	37,245
Winnebago	126.46	37,938
Wood	140.55	42,165
Men. Ind. Res.	44.75	13,425
Totals	10,201.57	$ 3,060,471

Funds allotted to cities for maintenance of connecting streets, 1925			
County	City	Mileage	Amount Allotted
	Reedsburg	2.53	$759
Shawano	Shawano	2.30	690
Sheboygan	Plymouth	2.10	630
	Sheboygan	4.90	1,470
Vernon	Viroqua	2.50	750
Walworth	Delavan	1.40	420
	Lake Geneva	2.90	870
	Whitewater	1.50	450
Washington	Hartford	2.10	630
	West Bend	1.70	510
Waukesha	Oconomowoc	2.60	780
	Waukesha	3.70	1,110
Waupaca	Clintonville	1.80	540
	New London	1.35	405
	Waupaca	1.55	465
Winnebago	Menasha	1.85	555
	Neenah	2.29	687
	Oshkosh	6.98	2,094
Wood	Marshfield	2.65	795
	Wisconsin Rapids	4.60	1,380
Totals		285.02	$ 85,506

Note: Remainder of table Ib is found on page 176.

TABLE II.—MAINTENANCE EXPENDITURES BY COUNTIES YEARS 1918 TO 1925 INCLUSIVE

This table shows amounts expended by the counties for the Maintenance of the State Trunk Highway System. Comparison with **Tables 1, 1a and 16** will show some counties have expended amounts in excess of the funds allotted. Such excess expenditures were financed by the counties.

County	1918	1919	1920	1921	1922	1923	1924	1925**	Total**
Adams	$ 14,521.95	$ 14,376.81	$ 14,615.09	$ 14,500.76	$ 25,915.99	$ 25,157.18	$ 24,388.48	$ 31,066.53	$ 164,542.79
Ashland	17,631.09	21,392.93	26,213.43	23,312.94	22,430.39	34,859.12	36,222.36	40,333.84	222,396.10
Barron	14,830.37	25,910.61	31,258.53	34,322.20	28,154.80	29,433.26	50,949.24	41,568.37	256,427.38
Bayfield	16,656.83	22,704.59	19,831.32	25,710.24	38,567.50	54,773.29	43,339.50	49,981.25	271,564.52
Brown	17,312.26	18,701.22	47,001.57	45,537.96	50,208.22	59,044.60	54,505.92	62,614.02	354,925.77
Buffalo	15,868.43	24,633.96	26,879.78	31,146.25	25,984.56	45,674.64	41,011.14	44,783.46	255,982.22
Burnett	5,622.89	9,418.79	9,976.00	21,055.79	16,829.27	18,458.29	34,916.16	26,628.70	142,905.89
Calumet	9,865.10	13,975.80	23,418.51	24,067.48	18,700.53	32,787.22	38,619.03	34,132.92	195,566.59
Chippewa	18,019.06	23,669.14	46,901.17	40,159.69	49,514.07	56,286.03	94,411.53	104,973.94	433,934.63
Clark	10,477.69	17,826.27	29,898.32	52,561.47	40,610.51	55,522.00	54,025.93	81,176.84	342,099.03
Columbia	24,948.59	30,237.78	37,201.82	56,119.84	44,053.32	62,180.46	85,828.95	83,046.89	423,617.65
Crawford	10,928.29	11,752.52	18,460.29	24,707.16	26,339.39	29,226.46	39,202.65	36,473.46	197,090.22
Dane	22,484.31	41,919.49	75,081.71	96,878.74	53,829.83	121,792.25	151,968.04	115,681.03	679,635.40
Dodge	25,121.27	26,896.77	32,828.33	57,633.87	42,278.69	26,942.61	34,216.71	74,050.70	319,968.95
Door	7,359.04	8,027.91	17,720.90	18,674.71	17,590.45	16,441.27	43,068.76	40,742.74	169,625.78
Douglas	12,399.09	19,173.73	20,742.33	25,122.71	26,863.38	27,392.38	50,382.47	41,779.22	223,855.31
Dunn	12,314.65	8,259.42	19,568.79	25,535.32	31,357.92	34,564.93	59,200.61	65,680.43	256,482.07
Eau Claire	11,673.33	16,910.42	26,361.45	34,777.20	26,282.23	51,940.79	68,927.90	53,598.10	290,471.42
Florence	5,391.97	6,056.69	6,012.51	8,678.73	7,082.49	9,371.45	16,559.08	11,905.46	71,058.38
Fond du Lac	21,886.51	31,447.73	67,539.22	45,838.74	41,161.73	31,655.18	80,333.46	51,627.77	371,490.34
Forest	12,498.15	14,095.31	16,786.31	17,745.34	23,530.49	34,386.80	37,269.24	42,728.91	199,040.55
Grant	20,236.86	23,622.81	57,889.78	55,116.11	60,180.42	72,961.96	65,875.59	79,905.00	435,788.53
Green	9,520.78	12,956.13	25,912.56	25,841.00	19,420.32	21,404.92	48,330.17	38,324.09	201,709.97
Green Lake	11,133.28	12,881.68	14,280.00	13,223.08	15,229.68	21,274.45	23,258.66	21,285.61	132,566.44
Iowa	9,151.91	8,822.61	20,217.74	35,885.19	22,087.49	18,163.44	52,387.19	41,753.95	208,469.52
Iron	8,530.33	11,582.10	12,582.59	13,498.62	14,931.47	17,606.46	31,090.93	25,247.86	135,070.36
Jackson	9,607.10	11,133.86	20,139.86	25,022.33	35,055.70	26,744.70	42,603.76	46,302.74	216,609.25
Jefferson	15,178.34	23,379.34	34,687.13	49,534.46	42,872.52	41,645.29	43,979.77	52,102.37	303,379.22
Juneau	13,284.55	26,805.60	22,369.83	34,827.27	23,921.27	20,640.50	37,199.82	47,594.89	226,643.73
Kenosha	5,860.77	7,934.24	13,752.96	13,477.89	17,589.99	15,645.61	28,531.38	29,556.39	132,349.23
Kewaunee	10,509.01	8,272.05	13,868.43	23,437.85	17,954.05	16,484.71	36,349.56	23,485.83	150,361.49
La Crosse	10,640.64	14,223.91	28,478.72	28,261.47	32,215.35	31,305.15	34,378.78	34,924.46	209,428.48
Lafayette	7,710.36	14,975.18	42,492.00	33,397.42	28,574.09	31,750.52	45,921.95	46,916.34	251,737.86
Langlade	5,996.24	6,312.69	14,536.29	22,404.40	21,281.03	25,442.67	39,883.64	39,630.89	175,487.85
Lincoln	7,842.67	8,619.54	11,731.32	12,421.24	20,885.45	30,454.28	51,506.97	46,813.68	190,275.15

Manitowoc	12,747.80	16,564.49	23,459.12	29,970.86	32,726.41	53,386.34	101,122.45	65,008.64	334,986.11
Marathon	18,146.07	32,402.22	45,981.21	42,382.32	37,525.64	46,951.34	61,111.53	68,830.44	353,330.77
Marinette	9,660.07	11,248.30	16,094.09	30,609.03	25,891.23	32,980.44	46,250.15	44,133.16	216,866.47
Marquette	8,196.56	8,509.21	12,149.82	11,973.17	13,531.69	14,392.19	24,223.70	19,664.51	112,640.85
Milwaukee	17,664.95	23,380.46	40,186.49	79,769.66	52,397.75	77,888.21	76,877.92	74,350.11	442,515.55
Monroe	18,536.62	13,240.09	26,878.15	33,246.25	35,511.59	35,906.66	50,081.66	54,953.70	268,354.72
Oconto	11,891.01	15,253.60	24,902.04	36,092.46	43,738.28	63,620.71	62,445.47	44,430.42	302,373.99
Oneida	19,667.15	27,304.87	30,678.26	34,330.15	36,389.26	46,455.82	49,820.79	65,553.50	310,199.80
Outagamie	9,865.28	16,396.70	22,582.23	34,455.06	33,042.37	37,227.49	54,433.13	57,633.58	265,635.84
Ozaukee	6,803.09	22,522.50	20,977.44	22,370.84	30,807.78	20,572.74	27,646.89	25,294.76	176,996.04
Pepin	5,340.10	8,936.29	9,241.99	10,318.60	11,944.82	11,538.29	21,953.37	19,514.97	98,788.43
Pierce	8,973.71	10,143.86	21,499.11	28,493.76	17,037.95	36,716.79	57,387.01	62,386.84	242,639.03
Polk	13,650.29	17,789.08	25,176.71	25,743.99	20,122.83	33,514.69	43,275.78	42,158.62	221,431.99
Portage	12,744.54	16,247.18	28,589.28	28,403.33	31,345.54	30,509.19	63,716.58	42,362.53	253,918.17
Price	14,457.03	18,037.72	17,044.04	25,200.03	31,327.52	36,943.74	51,476.98	40,737.30	235,224.36
Racine	17,715.83	28,782.98	23,164.91	30,404.25	16,559.52	19,272.75	54,008.22	64,417.59	254,326.05
Richland	17,556.94	25,493.00	26,125.72	28,189.42	25,003.42	23,624.51	45,191.13	39,084.08	230,268.22
Rock	15,678.91	12,613.81	32,944.96	43,268.26	44,690.12	48,221.71	77,563.26	57,811.28	332,792.31
Rusk	15,988.66	15,033.62	10,941.58	23,793.59	19,350.41	24,376.90	43,077.14	33,131.47	185,693.37
St. Croix	9,798.70	12,819.82	29,966.76	33,495.39	35,510.52	57,110.59	70,962.09	72,071.05	321,734.92
Sauk	34,415.18	34,060.32	66,607.58	53,890.52	37,879.25	82,415.01	68,531.89	79,062.88	456,862.63
Sawyer	10,434.30	11,738.75	15,118.70	17,075.86	20,461.03	33,029.42	37,939.87	43,568.59	189,366.52
Shawano*	17,601.85	24,903.73	39,024.86	48,186.30	43,098.12	56,734.06	69,970.25	60,864.36	360,383.53
Sheboygan	14,054.25	42,223.46	47,247.67	56,600.82	32,324.06	37,523.87	60,930.50	72,966.98	363,871.61
Taylor	5,370.95	5,426.37	12,364.92	22,562.54	25,725.07	31,057.35	35,799.35	39,816.08	178,122.63
Trempealeau	20,644.59	23,080.98	46,359.91	52,433.62	45,745.54	51,213.51	65,042.50	58,843.56	363,364.21
Vernon	12,442.07	10,504.88	30,109.43	41,172.49	32,125.90	40,654.47	58,027.67	60,737.13	285,774.04
Vilas	13,242.16	11,573.18	16,540.63	18,042.80	19,567.15	27,656.82	33,823.71	26,045.39	166,491.84
Walworth	18,944.13	30,127.82	50,260.68	79,386.97	35,552.31	37,470.15	49,285.47	56,150.60	357,178.13
Washburn	16,049.53	16,902.05	21,547.93	19,413.72	22,581.35	26,648.71	33,682.04	46,775.04	203,600.37
Washington	17,387.28	12,981.26	34,483.76	25,190.63	16,994.83	18,469.49	31,070.79	60,232.68	216,810.72
Waukesha	24,824.80	16,525.90	71,826.48	53,908.16	26,337.11	76,087.89	70,140.92	34,061.31	373,712.57
Waupaca	14,850.29	28,293.91	36,181.65	65,816.77	37,796.79	34,267.71	67,901.85	57,553.51	342,662.48
Waushara	15,119.43	26,562.55	25,220.19	25,291.52	26,986.65	37,849.70	39,669.08	45,083.57	241,782.69
Winnebago	10,949.97	14,132.22	40,174.17	31,599.83	23,318.42	27,642.38	38,384.94	36,092.26	222,294.19
Wood	13,002.23	12,941.15	20,822.50	18,187.98	26,998.55	27,347.26	45,492.46	44,248.01	209,040.14
Menominee Ind. Res.*	------------	------------	1,119.23	9,707.43	8,771.15	7,902.22	13,363.50	13,398.68	54,262.21
Totals	$977,430.03	$1,273,607.96	$2,005,829.99	$2,381,413.85	$2,106,202.52	$2,654,595.99	$3,622,327.39	$3,537,447.86	$18,558,855.59

*Menominee Indian Reservation Part of Shawano County is treated separately.
** 1925 expenditures not complete when this report was made.

1b (Cont.) MAINTENANCE FUNDS ALLOTTED TO SWING AND LIFT BRIDGES—1925

County		City or Village	Name of Bridge	Name of Stream	Length of Movable Part	Amount Allotted
Brown	C	Green Bay	Main Street Bridge	Fox River	125.0	$2,000
Brown	C	Green Bay	East River Bridge	East River	70.0	1,000
Brown	C	De Pere	Main Street Bridge	Fox River	114.0	2,000
Brown	V	Wrightstown	Wrightstown Bridge	Fox River	145.5	2,000
Columbia	C	Portage	Canal Br. on S.T.H. No. 33	Fox River Canal	109.5	2,000
Columbia	C	Portage	Canal Br. on S.T.H. No. 10	Fox River Canal	103.0	2,000
Douglas	C	Superior	Lamborn Ave. Bridge	St. Louis Bay	290.0	5,000
Green Lake	C	Princeton	Princeton Bridge	Fox River	162.0	3,000
Green Lake	C	Berlin	Berlin Bridge	Fox River	168.0	3,000
Kenosha	C	Kenosha	Main Street Bridge	Pike River	158.0	3,000
Kewaunee	C	Kewaunee	Kewaunee Bridge	Kewaunee River	181.0	3,000
La Crosse	C	La Crosse	La Crosse River	Mississippi River	445.0	5,000
Manitowoc	C	Manitowoc	Tenth Street Bridge	Manitowoc River	108.0	2,000
Manitowoc	C	Two Rivers	Washington Street Bridge	West Twin River	115.0	2,000
Manitowoc	C	Two Rivers	Seventeenth St. Bridge	East Twin River	174.0	3,000
Milwaukee	C	Milwaukee	Kinnickinnic Bridge	Kinnickinnic River	120.0	2,000
Milwaukee	C	Milwaukee	Broadway Bridge	Milwaukee River	122.0	2,000
Milwaukee	C	Milwaukee	Oneida Bridge	Milwaukee River	100.0	1,000
Oconto	C	Oconto	Brazeau Bridge	Oconto River	120.0	2,000
Outagamie	V	Shiocton	Shiocton Bridge	Wolf River	124.0	2,000
Outagamie	C	Kaukauna	Main Street Bridge	Fox River	146.0	2,000
Racine	C	Racine	Main Street Bridge	Root River	240.2	4,000
Racine	C	Racine	State Street Bridge	Root River	124.0	2,000
Sauk and Dane	V	Sauk City	Sauk City Bridge	Wisconsin River	78.0	1,000
Sauk and Columbia	V	Prairie du Sac	Prairie du Sac Bridge	Wisconsin River	97.0	1,000
Sheboygan	C	Sheboygan	Eighth Street Bridge	Sheboygan River	120.0	2,000
Waupaca	V	Fremont	Fremont Bridge	Wolf River	78.0	1,000
Waupaca	V	Northport	Northport Bridge	Wolf River	180.0	3,000
Waupaca	C	New London	Pearl St. Bridge	Wolf River	146.0	2,000
Waupaca	C	New London	Shawano St. Bridge	Wolf River	186.0	3,000
Winnebago	V	Omro	Omro Bridge	Fox River	78.8	1,000
Winnebago	V	Winneconne	Winneconne Bridge	Wolf River	165.0	3,000
Winnebago	C	Oshkosh	Main Street Bridge	Fox River	186.0	3,000
Winnebago	C	Oshkosh	West Algoma Bridge	Fox River	140.5	2,000
Winnebago	C	Menasha	Washington Bridge	Fox River	123.0	2,000
Totals						$81,000

TABLE IIa—MAINTENANCE EXPENDITURES, 1918

State Trunk Highway

County	Patrol	Gang	Marking and Signing	Pat. Supt.	Total
Adams	$7,667.38	$6,775.82	$78.75		$14,521.95
Ashland	9,852.38	7,778.71			17,631.09
Barron	11,173.90	3,541.18	115.29		14,830.37
Bayfield	10,164.74	6,430.59	61.50		16,656.83
Brown	10,312.78	6,609.56	389.92		17,312.26
Buffalo	11,512.69	4,262.31	93.43		15,868.43
Burnett	3,697.67	1,844.71	80.51		5,622.89
Calumet	7,529.01	2,190.79	145.30		9,865.10
Chippewa	7,780.60	10,087.93	150.53		18,019.06
Clark	10,250.94	94.48	132.27		10,477.69
Columbia	13,406.43	11,250.86	291.30		24,948.59
Crawford	7,316.27	3,550.85	61.17		10,928.29
Dane	16,154.84	6,214.26	115.21		22,484.31
Dodge	12,076.38	12,889.01	155.88		25,121.27
Door	5,455.90	1,836.41	66.73		7,359.04
Douglas	8,336.19	3,928.80	134.10		12,399.09
Dunn	9,600.33	2,636.96	77.36		12,314.65
Eau Claire	10,067.66	1,374.12	231.55		11,673.33
Florence	5,391.97				5,391.97
Fond du Lac	9,849.39	12,037.12			21,886.51
Forest	9,186.78	3,113.06	198.31		12,498.15
Grant	12,105.98	8,042.68	88.20		20,236.86
Green	3,879.57	5,641.21			9,520.78
Green Lake	4,501.11	6,590.92	41.25		11,133.28
Iowa	7,955.71	1,058.84	137.36		9,151.91
Iron	6,520.09	2,006.82	3.42		8,530.33
Jackson	7,187.65	2,371.25	48.20		9,607.10
Jefferson	7,142.56	7,915.44	120.34		15,178.34
Juneau	10,549.00	2,648.61	86.94		13,284.55
Kenosha	4,520.93	1,339.84			5,860.77
Kewaunee	5,983.66	4,487.71	37.64		10,509.01
La Crosse	10,519.04		121.60		10,640.64
Lafayette	6,714.95	995.41			7,710.36
Langlade	4,812.95	1,105.14	78.15		5,996.24
Lincoln	4,504.10	3,297.82	40.75		7,842.67
Manitowoc	9,232.88	3,244.92	270.00		12,747.80
Marathon	11,332.43	6,720.73	92.91		18,146.07
Marinette	5,269.13	4,258.93	132.01		9,660.07
Marquette	4,281.89	3,828.79	85.88		8,196.56
Milwaukee	2,118.77	15,546.18			17,664.95
Monroe	13,254.94	4,969.42	312.26		18,536.62
Oconto	7,980.72	3,781.69	128.60		11,891.01
Oneida	15,853.63	3,396.11	417.41		19,667.15
Outagamie	4,469.88	5,281.65	113.75		9,865.28
Ozaukee	1,825.78	4,938.24	39.07		6,803.09
Pepin	639.04	4,701.06			5,340.10
Pierce	7,558.89	1,309.55	105.27		8,973.71
Polk	6,823.60	6,742.10	84.59		13,650.29
Portage	8,364.48	3,999.07	380.99		12,744.54
Price	9,232.69	5,093.48	130.86		14,457.03
Racine	8,823.76	8,892.07			17,715.83
Richland	12,486.44	4,916.66	153.84		17,556.94
Rock	3,004.41	12,674.50			15,678.91
Rusk	6,957.45	8,873.66	157.55		15,988.66
St. Croix	9,531.20	175.00	92.50		9,798.70
Sauk	15,728.21	18,686.97			34,415.18
Sawyer	7,680.82	2,660.27	93.21		10,434.30
Shawano	11,718.81	5,594.94	288.10		17,601.85
Sheboygan	7,378.85	6,675.40			14,054.25
Taylor	3,232.95	2,110.14	27.86		5,370.95

TABLE IIa—Cont.

County	Patrol	Gang	Marking and Signing	Pat. Supt.	Total
Trempealeau	$10,947.80	$9,446.05	$250.74		$20,644.57
Vernon	6,419.04	5,761.40	261.63		12,442.09
Vilas	6,629.10	6,585.84	27.22		13,242.16
Walworth	10,119.80	8,701.03	123.30		18,944.13
Washburn	8,718.59	7,330.94			16,049.53
Washington	6,825.44	10,561.84			17,387.28
Waukesha	8,485.91	16,208.49	130.40		24,824.80
Waupaca	5,674.49	9,032.08	143.72		14,850.29
Waushara	8,369.76	6,640.78	108.89		15,119.43
Winnebago	5,817.71	4,988.36	143.90		10,949.97
Wood	6,571.34	6,222.09	208.80		13,002.23
Totals	$573,042.16	$396,499.65	$7,888.22		$977,430.03

TABLE IIb—MAINTENANCE EXPENDITURES, 1919
State Trunk Highway

County	Patrol	Gang	Mark and Sign	Pat. Supt.	Total
Adams	$9,693.92	$4,559.16	$123.73		$14,376.81
Ashland	10,875.13	10,517.80			21,392.93
Barron	13,848.90	11,785.76	275.95		25,910.61
Bayfield	11,659.43	10,511.06	534.10		22,704.59
Brown	17,830.42	222.50	648.30		18,701.22
Buffalo	19,308.33	4,659.41	666.22		24,633.96
Burnett	5,275.16	4,006.53	137.10		9,418.79
Calumet	10,423.56	3,269.94	282.30		13,975.80
Chippewa	11,549.46	11,973.18	146.50		23,669.14
Clark	13,303.58	3,962.30	560.39		17,826.27
Columbia	15,044.78	14,963.70	229.30		30,237.78
Crawford	11,184.18	568.34			11,752.52
Dane	20,698.85	20,620.81	599.83		41,919.49
Dodge	15,073.49	11,605.48	217.80		26,896.77
Door	6,289.02	1,672.19	66.70		8,027.91
Douglas	9,497.54	9,435.49	240.70		19,173.73
Dunn	8,155.07		104.35		8,259.42
Eau Claire	13,168.58	3,739.34	2.50		16,910.42
Florence	6,042.19		14.50		6,056.69
Fond du Lac	11,829.03	18,945.74	105.04	$567.92	31,447.73
Forest	12,503.19	1,378.62	213.50		14,095.31
Grant	19,265.12	4,092.09	265.60		23,622.81
Green	9,920.65	3,029.23	6.25		12,956.13
Green Lake	5,604.98	7,220.15	56.55		12,881.68
Iowa	8,822.61				8,822.61
Iron	7,561.35	3,952.20	68.55		11,582.10
Jackson	9,017.71	1,937.10	179.05		11,133.86
Jefferson	10,193.43	11,115.07	1,480.34	590.50	23,379.34
Juneau	13,961.72	12,524.53	319.35		26,805.60
Kenosha	7,793.79		140.45		7,934.24
Kewaunee	7,200.05	875.60	196.40		8,272.05
La Crosse	14,054.86		169.05		14,223.91
Lafayette	8,061.34	6,913.84			14,975.18
Langlade	5,892.01	420.68			6,312.69
Lincoln	6,211.88	2,283.51	124.15		8,619.54
Manitowoc	13,338.15	2,784.34	442.00		16,564.49
Marathon	14,748.85	16,578.82	40.45	1,034.10	32,402.22
Marinette	6,550.93	4,433.62	263.75		11,248.30
Marquette	4,748.28	3,667.08	93.85		8,509.21
Milwaukee	1,976.26	21,404.20			23,380.46

TABLE IIb—Cont.

County	Patrol	Gang	Marking and Signing	Pat. Supt.	Total
Monroe	$11,023.63	$1,621.81	$594.65		$13,240.09
Oconto	10,816.77	3,878.00	558.83		15,253.60
Oneida	21,844.76	5,460.11			27,304.87
Outagamie	8,326.57	7,560.18	509.95		16,396.70
Ozaukee	10,548.52	11,973.35	.63		22,522.50
Pepin	3,220.76	5,418.33	297.20		8,936.29
Pierce	9,112.96	1,027.90	3.00		10,143.86
Polk	8,898.24	8,530.58	360.26		17,789.08
Portage	10,118.62	5,898.91	229.65		16,247.18
Price	14,810.56	2,523.23	703.93		18,037.72
Racine	11,772.91	17,010.07			28,782.98
Richland	14,530.87	10,716.44	245.69		25,493.00
Rock	8,754.93	3,810.19	48,69		12,613.81
Rusk	9,080.82	5,650.99	301.81		15,033.62
St. Croix	12,071.57	748.25			12,819.82
Sauk	23,492.59	9,418.26	1,149.47		34,060.32
Sawyer	7,881.71	3,606.29	250.75		11,738.75
Shawano	14,638.92	8,898.79	805.13	$560.89	24,903.73
Sheboygan	6,817.80	34,585.42	299.07	521.17	42.223,46
Taylor	4,482.20	661.16	283.01		5,426.37
Trempealeau	13,476.93	9,395.55	208.50		23,080.98
Vernon	7,682.42	2,385.36	437.10		10,504.88
Vilas	8,904.82	2,469.68	198.68		11,573.18
Walworth	14,116.98	15,801.77	209.07		30,127.82
Washburn	8,699.49	8,202.56			16,902.05
Washington	9,063.28	3,891.34	26.64		12,981.26
Waukesha	10,024.85	6,501.55			16,525.90
Waupaca	10,671.77	16,380.07	198.45	1,043.62	28,293.91
Waushara	12,298.13	14,117.04	147.38		26,562.55
Winnebago	7,107.01	6,763.30	261.91		14,132.22
Wood	10,118.71	1,993.79	432.11	396.54	12,941.15
Totals	$762,587.38	$488,529.68	$17,776.16	$4,714.74	$1,273,607.96

TABLE IIc—MAINTENANCE EXPENDITURES, 1920
State Trunk Highway

County	Patrol	Gang	Mark and Signing	Pat. Supt.	Total
Adams	$12,129.97	$2,437.64	$47.48		$14,615.09
Ashland	11,469.75	14,728.68	15.00		26,213.43
Barron	18,770.58	12,487.95			31.258.53
Bayfield	18,322.36	1,492.66	16.30		19,831.52
Brown	17,227.76	26,367.66	2,532.94	873.21	47,001.57
Buffalo	22,655.41	3,915.51	141.86	167.00	26,879.78
Burnett	8,333.96	1,393.84	248.20		9,976.00
Calumet	16,127.96	6,236.75	446.95	606.85	23,418.51
Chippewa	15,653.89	31,247.28			46,901.17
Clark	21,852.92	6,935.28	226.22	883.90	29,898.32
Columbia	19,633.50	17,137.69	430.63		37,201.82
Crawford	17,385.39	1,074.90			18,460.29
Dane	39,289.97	34,798.63	993.11		75.081,71
Dodge	23,621.35	9,066.21	140.77		32,828.33
Door	11,847.09	5,846.41	27.40		17,720.90
Douglas	18,302.05		2,440.28		20,742.33
Dunn	16,011.04	3,495.57	62.18		19,568.79
Eau Claire	17,745.93	8,244.78	370.74		26,361.45
Florence	5,997.76		14.75		6,012.51
Fond du Lac	29,849.93	36,683.54	133.90	871.85	67,539 22

TABLE IIc—Cont.

County	Patrol	Gang	Marking and Signing	Pat. Supt.	Total
Forest	$15,515.32	$767.98	$503.01	--------	$16,786.31
Grant	30,232.68	26,841.93	815.17	--------	57,889.78
Green	12,799.95	12,729.58	383.03	--------	25,912.56
Green Lake	7,777.69	6,397.41	104.90	--------	14,280.00
Iowa	16,267.17	3,890.57	60.00	--------	20,217.74
Iron	11,571.07	--------	261.52	$750.00	12,582.59
Jackson	16,523.48	3,252.85	362.73	--------	20,139.06
Jefferson	20,540.03	11,696.46	468.37	1,982.27	34,687.13
Juneau	16,135.91	6,083.91	150.01	--------	22,369.83
Kenosha	6,634.48	7,118.48	--------	--------	13,752.96
Kewaunee	11,102.77	2,605.48	160.18	--------	13,868.43
La Crosse	14,079.90	9,243.44	155.38	--------	23,478.72
Lafayette	18,586.87	23,706.10	199.03	--------	42,492.00
Langlade	13,386.29	944.50	205.50	--------	14,536.29
Lincoln	9,549.38	2,181.94	--------	--------	11,731.32
Manitowoc	17,150.99	5,591.38	716.75	--------	23,459.12
Marathon	23,091.36	21,291.88	--------	1,597.97	45,981.21
Marinette	12,527.20	3,146.21	420.68	--------	16,094.09
Marquette	8,040.97	4,073.14	35.71	--------	12,149.82
Milwaukee	4,241.42	32,288.80	3,656.27	--------	40,186.49
Menominee I. Res	1,119.23	--------	--------	--------	1,119.23
Monroe	22,009.13	3,489.25	525.83	853.94	26,878.15
Oconto	18,973.83	4,844.31	1,083.90	--------	24,902.04
Oneida	28,332.62	1,720.56	625.08	--------	30,678.26
Outagamie	16,842.06	3,841.78	1,497.69	400.70	22,582.23
Ozaukee	14,572.75	5,821.42	583.27	--------	20,977.44
Pepin	4,819.88	4,422.11	--------	--------	9,241.99
Pierce	15,923.46	5,326.52	249.13	--------	21,499.11
Polk	12,365.24	12,623.34	188.13	--------	25,176.71
Portage	22,302.15	5,609.95	438.23	238.95	28,589.28
Price	16,655.91	249.95	138.18	--------	17,044.04
Racine	13,712.81	9,023.47	428.63	--------	23,164.91
Richland	17,317.30	7,971.67	201.36	635.39	26,125.72
Rock	13,857.62	18,191.76	37.50	858.08	32,944.96
Rusk	10,941.58	--------	--------	--------	10,941.58
St. Croix	26,079.73	3,877.03	10.00	--------	29,966.76
Sauk	27,894.60	37,908.93	804.05	--------	66,607.58
Sawyer	13,722.50	1,206.42	189.78	--------	15,118.70
Shawano	26,538.98	11,820.74	665.14	--------	39,024.86
Sheboygan	16,687.58	29,548.39	141.44	870.26	47,247.67
Taylor	8,996.83	3,183.82	184.27	--------	12,364.92
Trempealeau	23,906.13	21,860.78	593.00	--------	46,359.91
Vernon	22,695.15	5,729.54	376.20	1,308.54	30,109.43
Vilas	16,540.63	--------	--------	--------	16,540.63
Walworth	27,434.14	22,468.25	358.29	--------	50,260.68
Washburn	11,527.16	10,020.77	--------	--------	21,547.93
Washington	13,453.11	20,771.81	258.84	--------	34,483.76
Waukesha	22,213.94	48,304.80	275.00	1,032.74	71,826.48
Waupaca	19,349.28	14,051.64	913.87	1,866.86	36,181.65
Waushara	18,140.76	7,005.78	73.65	--------	25,220.19
Winnebago	15,323.45	23,152.78	689.99	1,007.95	40,174.17
Wood	15,495.50	4,983.79	343.21	--------	20,822.50
Totals	$1,203,728.54	$756,474.38	$28,820.61	$16,806.46	$2,005,829.99

TABLE IId—MAINTENANCE EXPENDITURES, 1921
State Trunk Highway

County	Patrol	Gang	Marking and Signing	Pat. Supt.	Total
Adams	$13,289.19	$1,140.67	$70.90		$14,500.76
Ashland	14,437.89	8,419.74	455.31		23,312.94
Barron	19,155.78	14,542.64	623.78		34,322.20
Bayfield	23,218.15	2,492.09			25,710.24
Brown	20,925.27	24,001.14	611.55		45,537.96
Buffalo	20,774.77	10,041.38		$330.10	31,146.25
Burnett	9,663.32	11,175.67	216.80		21,055.79
Calumet	15,517.93	7,483.44	488.72	577.39	24,067.48
Chippewa	18,264.63	21,145.62	9.22	740.22	40,159.69
Clark	22,251.31	29,653.72	33,00	623.44	52,561.47
Columbia	28,356.69	27,483.51	279.64		56,119.84
Crawford	17,160.26	7,214.63	332.27		24,707.16
Dane	42,419.41	53,646.37	812.96		96,878.74
Dodge	27,212.19	30,167.27	254.41		57,633.87
Door	10,156.97	8,341.48	176.26		18,674.71
Douglas	17,185.85	5,964.19	257.25	1,715.42	25,122.71
Dunn	16,544.58	8,281.49	36.55	672.70	25,535.32
Eau Claire	17,212.35	16,946.17	327.41	291.27	34,777.20
Florence	6,437.57	2,196.07	45.10		8,678.73
Fond du Lac	26,297.52	18,620.04		921.18	45,838.74
Forest	15,172.07	2,256.31	316.96		17,745.34
Grant	33,414.57	20,750.59	950.95		55,116.11
Green	12,013.54	13,827.46			25,841.00
Green Lake	7,847.20	5,231.38	144.50		13,223.08
Iowa	16,267.86	19,297.13	320.20		35,885.19
Iron	10,920.51	2,553.11	25.00		13,498.62
Jackson	17,502.96	7,197.98	218.89	102.50	25,022.33
Jefferson	21,387.55	26,117.05	291.84	1,738.02	49,524.46
Juneau	18,708.40	15,197.58	336.31	584.98	34,827.27
Kenosha	6,213.12	7,202.27	62.50		13,477.89
Kewaunee	14,006.04	9,284.26	147.55		23,437.85
La Crosse	18,574.14	8,709.52	465.31	512.50	28,261.47
Lafayette	20,227.33	12,776.95	393.14		33,397.42
Langlade	14,272.48	8,114.92	17.00		22,404.40
Lincoln	10,609.49	1,811.75			12,421.24
Manitowoc	18,227.20	11,018.66	725.00		29,970.86
Marathon	24,482.95	16,314.33	46.03	1,539.01	42,382.32
Marinette	15,323.63	14,854.06	431.34		30,609.03
Marquette	9,048.06	2,801.94	123.17		11,973.17
Milwaukee	4,034.79	72,534.59	3,200.28		79,769.66
Monroe	24,598.74	7,455.56	495.79	696.16	33,246.25
Oconto	26,587.23	7,449.48	2,055.75		36,092.46
Oneida	29,776.42	4,501.34	52.39		34,330.15
Outagamie	23,549.06	9,873.26	1,032.74		34,455.06
Ozaukee	13,622.97	8,648.67	99.20		22,370.84
Pepin	4,415.65	5,902.95			10,318.60
Pierce	16,447.04	12,000.39	46.33		28,493.76
Polk	12,601.00	12,901.40	241.59		25,743.99
Portage	24,089.74	3,729.02	275.87	308.70	28,403.33
Price	18,123.08	6,716.53	360.42		25,200.03
Racine	12,343.87	17,608.73	451.63		30,404.25
Richland	22,764.70	4,455.39	137.73	831.60	28,189.42
Rock	19,295.38	22,372.02	202.87	1,397.99	43,268.26
Rusk	13,986.36	9,492.93	314.30		23,793.59
St. Croix	24,799.82	8,695.57			33,495.39
Sauk	28,651.36	24,964.30	274.86		53,890.52
Sawyer	13,932.80	2,868.12	274.94		17,075.86
Shawano	28,892.95	18,865.86	427.49		48,186.30
Sheboygan	14,672.39	41,116.58	97.20	714.65	56,600.82
Taylor	10,751.89	11,153.35	59.00	598.30	22,562.54
Shawano Co. Menomonie Res	9,543.93		163.50		9,707.43

TABLE IId—Cont.

County	Patrol	Gang	Marking and Signing	Pat. Supt.	Total
Trempealeau	$24,030.35	$27,783.99	$619.28	----------	$52,433.62
Vernon	26,187.28	14,251.98	733.23	----------	41,172.49
Vilas	18,042.80	----------	----------	----------	18,042.80
Walworth	28,091.50	48,999.13	532.63	$1,763.71	79,386.97
Washburn	12,948.06	6,132.96	332.70	----------	19,413.72
Washington	10,093.91	14,977.72	41.50	77.50	25,190.63
Waukesha	22,825.23	28,818.03	1,229.23	1,035.67	53,908.16
Waupaca	27,514.72	36,075.30	241.45	1,985.30	65,816.77
Waushara	20,359.18	4,827.07	105.27	----------	25,291.52
Winnebago	14,724.75	15,307.00	864.26	703.82	31,599.83
Wood	13,465.42	4,222.24	500.32	----------	18,187.98
Totals	$1,306,465.10	$1,028,976.04	$25,510.57	$20,462.14	$2,381,413.85

TABLE IIe—MAINTENANCE OF STATE TRUNK HIGHWAY SYSTEM EXPENDITURES—1922

County	Patrol	Gang	Marking and Signing	Pat. Supt.	Totals
Adams	$12,153.10	$13,571.14	$191.75	----------	$25,915.99
Ashland	18,404.28	3,368.16	657.95	----------	22,430.39
Barron	19,118.03	7,937.81	106.56	$992.40	28,154.80
Bayfield	26,414.53	11,179.29	501.18	472.50	38,567.50
Brown	22,025.52	23,681.22	3,846.54	654.94	50,208.22
Buffalo	21,962.81	2,694.20	594.45	733.10	25,984.56
Burnett	13,394.89	2,874.84	559.54	----------	16,829.27
Calumet	13,588.74	4,312.28	799.51	----------	18,700.53
Chippewa	19,237.66	28,919.55	576.81	780.05	49,514.07
Clark	19,529.88	20,243.60	837.03	----------	40,610.51
Columbia	37,341.79	5,965.43	746.10	----------	44,053.32
Crawford	15,394.45	10,766.74	178.20	----------	26,339.39
Dane	39,310.28	13,811.37	708.18	----------	53,829.83
Dodge	25,909.26	14,484.77	397.30	1,487.36	42,278.69
Door	10,841.80	6,139.91	608.74	----------	17,590.45
Douglas	18,844.38	5,366.91	761.24	1,890.85	26,863.38
Dunn	20,958.19	9,294.12	340.78	764.83	31,357.92
Eau Claire	15,113.57	10,688.50	480.16	----------	26,282.23
Florence	5,943.32	999.38	139.79	----------	7,082.49
Fond du Lac	18,192.13	20,981.32	1,065.86	922.42	41,161.73
Forest	18,293.03	2,566.53	1,018.99	1,651.94	23,530.49
Grant	32,686.18	27,366.30	127.94	----------	60,180.42
Green	11,630.37	7,271.00	518.95	----------	19,420.32
Green Lake	9,083.86	5,857.27	288.55	----------	15,229.68
Iowa	14,838.25	7,199.62	49.62	----------	22,087.49
Iron	12,518.02	2,190.88	222.57	----------	14,931.47
Jackson	21,820.92	11,985.34	636.02	613.42	35,055.70
Jefferson	23,485.66	16,438.72	820.41	2,127.73	42,872.52
Juneau	16,469.62	6,517.80	245.33	688.52	23,921.27
Kenosha	5,851.57	11,601.53	136.89	----------	17,589.99
Kewaunee	11,769.45	5,263.49	921.11	----------	17,954.05
La Crosse	19,513.99	12,144.32	227.62	329.42	32,215.35
Lafayette	19,045.57	9,164.43	364.09	----------	28,574.09
Langlade	15,548.13	5,451.66	281.24	----------	21,281.03
Lincoln	12,925.67	6,693.27	586.84	679.67	20,885.45
Manitowoc	18,906.24	12,648.24	1,171.93	----------	32,726.41
Marathon	24,067.51	11,289.54	254.11	1,914.48	37,525.64
Marinette	16,967.87	7,238.55	1,230.61	454.20	25,891.23
Marquette	8,869.26	4,465.11	197.32	----------	13,531.69
Milwaukee	1,675.09	44,715.73	6,006.93	----------	52,397.75

TABLE IIe—Cont.

County	Patrol	Gang	Marking and Signing	Pat. Supt.	Total
Monroe	$25,807.85	$7,981.89	$746.96	$974.89	$35,511.59
Oconto	27,038.46	14,902.66	466.61	1,330.55	43,738.28
Oneida	31,142.18	4,240.10	1,006.98		36,389.26
Outagamie	28,555.95	2,698.90	871.64	915.88	33,042.37
Ozaukee	14,758.07	15,288.35	761.36		30,807.78
Pepin	5,129.66	6,644.41	170.75		11,944.82
Pierce	14,614.38	1,966.05	457.52		17,037.95
Polk	15,849.58	3,648.40	624.85		20,122.83
Portage	27,507.69	1,989.30	128.12	1,720.43	31,345.54
Price	21,963.78	8,194.60	1,169.14		31,327.52
Racine	9,759.74	5,775.34	1,024.44		16,559.52
Richland	20,186.45	3,835.84	179.13	802.00	25,003.42
Rock	25,846.44	16,004.41	771.75	2,067.52	44,690.12
Rusk	16,302.34	2,923.47	124.60		19,350.41
St. Croix	21,729.25	13,118.96	662.31		35,510.52
Sauk	28,048.67	9,031.49	799.09		37,879.25
Sawyer	15,543.56	4,557.01	360.46		20,461.03
*Shawano	29,131.66	13,013.68	952.78		43,098.12
Sheboygan	12,832.04	18,575.11	220.25	696.66	32,324.06
Taylor	11,886.60	12,970.58	424.99	442.90	25,725.07
Trempealeau	25,323.54	18,635.38	845.90	940.72	45,745.54
Vernon	29,423.08		1,661.84	1,040.98	32,125.90
Vilas	19,153.58		413.57		19,567.15
Walworth	25,622.21	7,529.88	439.50	1,960.72	35,552.31
Washburn	12,924.09	9,028.43	628.83		22,581.35
Washington	11,975.76	4,268.14		750.93	16,994.83
Waukesha	23,576.09	852.00	677.01	1,232.01	26,337.11
Waupaca	23,113.04	12,235.03	335.11	2,113.61	37,796.79
Waushara	21,281.51	5,360.39	344.75		26,986.65
Winnebago	13,690.42	7,844.16	866.84	917.00	23,318.42
Wood	14,505.42	10,991.68	699.62	801.83	26,998.55
*Menom. Res.	8,771.15				8,771.15
Totals	$1,342,639.11	$679,455.51	$48,241.44	$35,866.46	$2,106,202.52

* Menominee Reservation is a part of Shawano County but is treated separately.

TABLE IIf—MAINTENANCE OF STATE TRUNK HIGHWAY SYSTEM EXPENDITURES—1923

County	Total	General	Reconstruction	Betterments	Marking and Signing	Patrol Supt.
Adams	$ 25,157.18	$ 15,159.21		$ 9,873.97	$ 124.00	
Ashland	34,859.12	21,373.69	$4,687.92	7,652.85	1,144.66	
Barron	29,433.26	19,791.89		8,251.08	369.26	$1,021.03
Bayfield	54,773.29	29,201.21	3,233.68	20,509.89	773.97	1,054.54
Brown	59,044.60	53,231.07			4,851.30	962.23
Buffalo	45,674.64	24,167.30	17,445.83	3,373.06	50.60	637.85
Burnett	18,458.29	13,989.31		4,468.98		
Calumet	32,787.22	16,580.97	257.60	14,926.95	1,021.70	
Chippewa	56,286.03	20,030.67	23,118.05	12,245.27	8.10	883.94
Clark	55,522.00	20,115.10	30,029.79	5,208.86	168.25	
Columbia	62,180.46	46,752.38	7,670.02	7,331.26	376.15	50.65
Crawford	29,226.46	16,552.50		12,142.49	531.47	
Dane	121,792.25	42,052.83	78,095.71	289.82	1,353.89	
Dodge	26,942.61	21,107.36	82.96	3,400.90	473.54	1,877.85
Door	16,441.27	12,886.31	2,017.80	1,281.92	255.24	

TABLE IIf—Cont.

County	Total	General	Reconstruction	Betterments	Marking and Signing	Patrol Supt.
Douglas	$27,392.38	$23,720.19	$442.20	$556.95	$1,018.87	$1,654.17
Dunn	34,564.93	22,920.81	8,824.89	2,084.03	152.35	582.85
Eau Claire	51,940.79	15,551.38	28,599.23	6,701.47	450.52	638.19
Florence	9,371.45	5,964.77	3,268.54	----------	138.14	----------
Fond du Lac	31,655.18	30,667.05	----------	----------	----------	988.13
Forest	34,386.80	17,779.98	----------	13,842.49	992.95	1,771.38
Grant	72,961.96	48,071.05	1,706.92	22,992.94	191.05	----------
Green	21,404.92	12,561.10	8,045.52	----------	798.30	----------
Green Lake	21,274.45	17,552.30	----------	3,611.03	111.12	----------
Iowa	18,163.44	14,056.95	685.65	3,388.46	32.38	----------
Iron	17,606.46	11,790.41	----------	5,395.50	420.55	----------
Jackson	26,744.70	22,630.15	750.00	1,697.37	986.92	680.26
Jefferson	41,645.29	24,123.46	1,244.75	13,177.23	1,026.03	2,073.82
Juneau	20,640.50	18,973.96	----------	534.68	405.95	725.91
Kenosha	15,645.61	11,089.01	4,386.25	----------	170.35	----------
Kewaunee	16,484.71	11,618.87	1,431.21	2,689.36	745.27	----------
La Crosse	31,305.15	29,620.27	----------	----------	1,354.90	329.98
Lafayette	31,750.52	20,937.68	4,702.02	6,045.43	65.39	----------
Langlade	25,442.67	17,126.18	3,906.18	4,088.58	321.73	----------
Lincoln	30,454.28	15,604.05	12,466.20	699.31	857.58	827.14
Manitowoc	53,386.34	25,470.67	11,495.20	15,644.86	775.61	----------
Marathon	46,951.34	40,601.60	3,120.99	680.00	491.39	2,057.36
Marinette	32,980.44	20,289.62	6,178.24	5,654.23	607.00	251.35
Marquette	14,392.19	8,721.16	3,830.58	1,443.32	397.13	----------
Milwaukee	77,888.21	22,787.54	----------	53,893.83	1,206.84	----------
Monroe	35,906.66	28,770.22	----------	5,490.35	560.57	1,085.52
Oconto	63,620.71	29,603.63	1,935.23	29,236.24	1,199.21	1,646.40
Oneida	46,455.82	33,436.02	2,179.83	10,183.19	656.78	----------
Outagamie	37,227.49	35,954.42	----------	----------	433.20	839.87
Ozaukee	20,572.74	16,885.68	1,280.11	2,085.99	320.96	----------
Pepin	11,538.29	7,027.40	3,519.85	971.74	19.30	----------
Pierce	36,716.79	14,866.53	12,940.39	8,740.30	169.57	----------
Polk	33,514.69	18,428.35	----------	14,531.54	554.80	----------
Portage	30,509.19	25,670.35	----------	3,063.05	13.57	1,762.22
Price	36,943.74	25,008.53	----------	10,525.00	1,410.21	----------
Racine	19,272.75	18,749.84	----------	----------	522.91	----------
Richland	23,624.51	20,807.53	----------	1,945.82	201.81	669.35
Rock	48,221.71	35,178.14	8,815.85	2,578.90	----------	1,648.82
Rusk	24,376.90	18,406.86	433.23	4,900.57	636.24	----------
St. Croix	57,110.59	25,335.16	18,554.45	13,205.29	15.69	----------
Sauk	82,415.01	31,513.27	49,513.51	----------	----------	1,388.2
Sawyer	33,029.42	18,620.25	----------	13,095.77	228.15	1,085.25
Shawano	56,734.06	37,723.20	14,325.69	3,979.69	705.48	----------
Sheboygan	37,523.87	32,418.88	4,256.11	----------	322.31	526.57
Taylor	31,057.35	14,011.95	15,665.43	----------	362.17	1,017.80
Trempealeau	51,213.51	38,625.12	9,309.39	1,664.75	768.36	845.98
Vernon	40,654.47	38,500.82	----------	----------	1,040.68	1,112.97
Vilas	27,656.82	20,129.77	2,412.47	4,861.67	252.91	----------
Walworth	37,470.15	24,262.03	9,536.95	547.55	1,032.25	2,091.37
Washburn	26,648.71	14,528.10	----------	11,949.78	170.83	----------
Washington	18,469.49	16,476.53	1,214.55	----------	----------	778.41
Waukesha	76,087.89	21,901.69	----------	51,806.64	1,228.84	1,150.72
Waupaca	34,267.71	25,940.10	489.15	7,170.17	668.29	----------
Waushara	37,849.70	24,896.68	3,221.48	9,393.79	337.75	----------
Winnebago	27,642.38	25,904.69	----------	----------	943.15	794.54
Wood	27,347.26	15,150.09	9,135.70	1,650.23	515.32	895.92
Menomonie Res.	7,902.22	7,902.22	----------	----------	----------	----------
Totals	$2,654,595.99	$1,645,856.06	$440,463.30	$489,356.39	$40,511.76	$38,408.48

TABLE IIg—MAINTENANCE OF STATE TRUNK HIGHWAY SYSTEM—1924 EXPENDITURES

County	General Maintenance	Recon-struction	Better-ment	Marking and Signing	Patrol Supt.	Total
Adams	$19,213.87	$676.30	$3,699.53	$798.78	----------	$24,388.48
Ashland	29,195.14	------------	5,202.91	1,824.31	----------	36,222.36
Barron	26,428.27	1,303.97	21,332.25	672.19	$1,212.56	50,949.24
Bayfield	32,553.30	1,200.00	7,657.80	604.74	1,323.66	43,339.50
Brown	50,564.05	------------	------------	2,716.82	1,225.05	54,505.92
Buffalo	32,637.55	675.78	3,652.84	3,368.87	676.10	41,011.14
Burnett	19,576.51	------------	14,758.45	581.20	----------	34,916.16
Calumet	24,023.06	1,003.65	12,487.36	1,104.96	----------	38,619.03
Chippewa	29,990.77	33,818.30	26,775.76	2,992.94	833.76	94,411.53
Clark	32,545.55	18,032.05	1,200.00	1,777.57	470.76	54,025.93
Columbia	83,965.50	------------	------------	1,444.35	419.10	85,828.95
Crawford	21,590.11	474.20	16,493.65	644.69	----------	39,202.65
Dane	63,182.22	83,495.64	1,055.69	3,155.90	1,078.59	151,968.04
Dodge	29,239.18	3,598.20	------------	566.67	812.66	34,216.71
Door	14,136.50	------------	28,932.26	------------	----------	43,068.76
Douglas	36,426.98	------------	10,810.53	1,523.79	1,621.17	50,382.47
Dunn	32,791.40	18,148.35	5,959.32	1,748.27	553.27	59,200.61
Eau Claire	23,624.52	24,256.27	18,760.14	2,286.97	----------	68,927.90
Florence	9,528.61	2,365.27	3,995.87	669.33	----------	16,559.08
FondduLac	36,586.94	2,616.96	36,814.51	3,240.30	1,074.75	80,333.46
Forest	25,011.64	3,665.92	5,264.88	1,667.80	1,659.00	37,269.24
Grant	51,782.62	157.41	12,676.08	1,259.48	----------	65,875.59
Green	17,875.35	11,269.53	16,125.49	3,059.80	----------	48,330.17
Green Lake	18,901.19	------------	3,443.86	913.61	----------	23,258.66
Iowa	23,489.53	22,132.94	5,303.67	1,461.05	----------	52,387.19
Iron	13,521.13	------------	17,364.48	205.32	----------	31,090.93
Jackson	31,058.63	4,922.24	2,366.70	3,347.83	908.36	42,603.76
Jefferson	27,553.25	6,797.16	6,648.17	997.63	1,983.56	43,979.77
Juneau	23,108.30	4,203.15	7,883.36	2,005.01	----------	37,199.82
Kenosha	17,811.50	------------	9,350.96	1,368.92	----------	28,531.38
Kewaunee	15,166.71	------------	20,134.48	1,048.37	----------	36,349.56
La Crosse	32,519.48	------------	------------	1,471.23	388.07	34,378.78
Lafayette	23,823.71	4,589.89	16,479.77	1,028.60	----------	45,921.97
Langlade	33,336.26	915.24	2,807.45	1,541.84	1,282.85	39,883.64
Lincoln	29,977.19	15,129.60	2,762.03	2,676.97	961.18	51,506.97
Manitowoc	38,621.65	10,726.49	48,581.13	3,193.18	----------	101,122.45
Marathon	46,516.57	------------	10,080.44	2,107.75	2,406.77	61,111.53
Marinette	24,155.56	5,894.75	14,149.66	1,650.98	399.20	46,250.15
Marquette	12,828.54	481.70	10,290.39	623.07	----------	24,223.70
Milwaukee	42,807.19	------------	28,986.18	5,084.55	----------	76,877.92
Monroe	37,182.42	1,306.62	6,408.64	4,132.69	1,051.29	50,081.66
Oconto	33,916.09	------------	26,553.63	389.60	1,586.15	62,445.47
Oneida	39,303.56	7,426.96	------------	2,065.63	1,024.64	49,820.79
Outagamie	47,446.35	------------	4,696.21	1,428.27	862.30	54,433.13
Ozaukee	18,015.51	------------	8,776.99	302.68	551.71	27,646.89
Pepin	16,450.23	3,263.35	1,015.20	1,224.59	----------	21,953.37
Pierce	30,866.27	7,384.50	16,000.08	2,525.06	611.10	57,387.01
Polk	28,162.21	------------	13,325.41	1,788.16	----------	43,275.78
Portage	30,175.70	1,471.63	28,790.50	1,340.83	1,937.92	63.716.58
Price	36,025.49	5,951.01	6,729.19	1,405.90	1,365.39	51,476,98
Racine	28,222.81	------------	24,062.96	971.71	750.74	54,008.22
Richland	26,981.90	------------	15,986.06	1,392.47	830.70	45,191.13
Rock	43,039.05	3,885.10	28,819.72	------------	1,819.39	77,563.26
Rusk	21,556.34	------------	18,413.08	1,363.07	1,744.65	43,077.14
St. Croix	33,376.32	27,051.09	5,922.48	3,965.78	646.42	70,962.09
Sauk	45,790.59	15,979.98	3,926.25	1,081.61	1,753.46	68,531.89
Sawyer	22,833.59	------------	12,425.56	1,582.55	1,098.17	37,939.87
Shawano	32,782.60	17,833.68	19,020.17	333.80	----------	69,970.25
Sheboygan	46,357.31	------------	11,495.75	2,194.52	882.92	60,930.50
Taylor	18,834.38	5,618.14	9,804.95	997.71	544.17	35,799.35

TABLE IIg—Cont.

County	General Maintenance	Recon-struction	Better-ments	Marking and Signing	Patrol Supt.	Total
Trempealeau	$40,054.53	$20,375.45	----------	$3,889.47	$723.05	$65,042.50
Vernon	47,877.27	2,620.56	$2,990.70	3,234.99	1,304.15	58,027.67
Vilas	19,082.14	----------	13,769.59	762.24	209.74	33,823.71
Walworth	26,028.98	----------	20,051.98	1,142.37	2,062.14	49,285.47
Washburn	20,358.54	2,536.84	9,657.22	1,129.44	----------	33,682.04
Washington	26,060.86	----------	2,359.80	1,573.78	1,076.35	31,070.79
Waukesha	41,494.31	----------	22,095.46	5,400.65	1,150.50	70,140.92
Waupaca	36,675.17	5,351.52	20,642.80	2,668.66	2,563.70	67,901.85
Waushara	26,487.61	4,031.67	8,526.70	623.10	----------	39,669.08
Winnebago	36,155.25	----------	----------	2,229.69	----------	38,384.94
Wood	26,446.22	4,631.45	12,249.39	2,165.40	----------	45,492.46
Men. Ind. Res.	3,792.65	----------	9,399.86	170.99	----------	13,363.50
Totals	$2,185,498.28	$ 419,270.51	$ 844,204.38	$ 123,913.05	$49,441.17	$3,622,327.39

Note: For table 2h see page 188.

TABLE III—EXPENDITURES PER MILE FOR DIFFERENT TYPES OF HIGHWAYS 1918–1925 INCLUSIVE

TYPE	1918				1919			
	Miles	Patrol Maint.	Gang Maint.	Total	Miles	Patrol Maint.	Gang Maint.	Total
Concrete	No class	ification	record by	types.				
Stone Macadam		114.63	79.32	*193.25	167	228.80	287.01	515.81
Gravel, etc.	4999				341	133.63	78.28	211.91
Earth, Top Soil, etc.					645	154.01	68.92	222.93

TYPE	1920				1921			
	Miles	Patrol Maint.	Gang Maint.	Total	Miles	Patrol Maint.	Gang Maint.	Total
Concrete	96	37.07	183.11	220.18	87	174.05	148.20	322.25
Stone Macadam	249	167.74	376.40	544.18	112	204.39	224.04	428.43
Gravel, etc.	1340	184.68	212.70	397.38	912	193.85	179.20	373.05
Earth, Top Soil, etc.	1753	187.24	95.87	283.11	845	196.21	53.78	249.99

* Average cost for all types.

TABLE III—Cont.

TYPE	1922				1923			
	Miles	Patrol Maint.	Gang Maint.	Total	Miles	Patrol Maint.	Gang Maint.	Total
Concrete	185	115.96	97.07	213.03	296	157.50	36.90	194.40
Stone Macadam	75	216.48	265.54	482.02	44	354.90	1.90	356.80
Gravel, etc.	1148	189.35	109.74	299.09	1190	217.00	179.60	396.60
Earth, Top Soil, etc.	814	188.04	47.93	235.97	773	196.20	47.10	243.30
Tar Surface Treated Gravel					28.8			*1190.00

* Includes several miles wider than 18 feet.

TYPE	1924				1925			
	Miles	Patrol Maint.	Gang Maint.	Total	Miles	Patrol Maint.	Gang Maint.	Total
Concrete	777	197.7	40.7	238.40	952	165.60	40.40	206.00
Stone Macadam	96	264.8	63.2	328.00	75	298.80	4.10	302.90
Gravel	2115	254.4	243.2	498.10	2767	240.00	142.40	382.40
Earth, Top Soil, etc.	1058	190.8	100.6	291.40	1042	231.00	50.70	281.70
Tar Surfaced Treated Gravel	150			1250	*400			*1000.00

* Approximate.

Costs of maintenance are very difficult to state accurately for the reason that it is impossible to fix any standard by which the results may be measured. In road construction there are definite specifications which are a measure of what must be delivered and definite cost records can be kept. But maintenance is naturally a day labor proposition. It is never possible to know in advance just what must be done. The maintenance forces must make such repairs as are necessary after the damage is done and there is no way of measuring exactly what has been done. For this reason, figures given as the cost of maintaining various types of road are, in reality, statements of amounts of money that have been expended for such maintenance. Such figures are given in the foregoing tables:

It will be noted that the amounts expended in the maintenance of stone and gravel roads are higher than the amounts expended in the maintenance of the earth roads and the amounts expended on concrete roads are nearly as high. This seems to be a paradox. If it is cheaper to maintain an earth road, than a road of higher type, why should the higher type road be constructed?

(Continued on page 190)

TABLE IIh

County	General Maintnance	Reconstruction	Betterments	Marking and Signing	Patrol Superintendent	Total
Adams	$ 20,030.23	$ 8,917.71	$ 1,361.11	$ 757.48		$ 31,066.53
Ashland	35,681.00	1,330.23	1,391.78	857,14	1,073.69	40,333.84
Barron	29,737.87	2,996.98	6,214.81	1,350.02	1,268.69	41,568.37
Bayfield	37,257.66		7,943.25	3,217.59	1,562.75	49,981.25
Brown	59,636.11			1,679.79	1,298.12	62,614.02
Buffalo	38,518.01	98,15	3,762.62	1,446.93	957.75	44,783.46
Burnett	18,826.88	2,679.83	5,121.99			26,628.70
Calumet	23,981.95	1,000.00	8,065.76	1,085.21		34,132.92
Chippewa*	33,808.74	49,300.72	20,221.95	692.13	950.40	104,973.94
Clark*	36,280.66	35,065.15	7,170.43	1,613.07	1,047.53	81,176.84
Columbia	59,021.01		19,605.19	3,549.79	870.90	83,046.89
Crawford	24,416.33	178.60	10,872.81	1,005.72		36,473.46
Dane	82,623.13		28,937.34	1,068.36	3,052.20	115,681.03
Dodge	24,450.42	48,710.24		372.48	517.56	74,050.70
Door	17,960.79	90.00	21,801.41	890.54		40,742.74
Douglas	40,730.75			1,048.47		41,779.22
Dunn*	34,860.19	20,913.57	9,449.64	413.96	43.07	65,680.43
Eau Claire*	24,549.65	26,394.98	1,140.74	993.93	518.80	53,598.10
Florence	10,314.09	1,081.16	146.25	363.96		11,905.46
Fond du Lac*	31,883.40	5,199.65	11,843.92	1,599.46	1,101.34	51,627.77
Forest	33,329.26	5,607.31	2,795.50	894.64	102.20	42,728.91
Grant	55,477.26	16,606.01	5,779.89	2,041.84		79,905.00
Green	19,405.04	11,164.20	7,737.22	17,63		38.324.09
Green Lake	15,795.56	4,682.47		807.58		21,285.61
Iowa	24,624.91	10,528.68	4,263.35	2,337.01		41,753.95
Iron	18,136.39	5,805.87		1,305.60		25,247.86
Jackson	34,368.06	8,033.61	2,573.04	419.93	908.10	46,302.74
Jefferson	30,134.71		18,692.38	971.50	2,303.78	52,102.37
Juneau	27,004.96	983.40	18,803.97	802.56		47,594.89
Kenosha	16,801.56	582.43	11,730.83	441.57		29,556.39
Kewaunee	15,742.12		6,488.60	942.51	312.60	23,485.83
La Crosse	34,105.69			420.89	397.88	34,924.46
Lafayette	27,431.78	12,333.24	4,054.87	2,106.45		46,916.34
Langlade	36,117.03	1,503.40		461.36	1,549.10	39,630.89
Lincoln	30,526.40	8,311.55	5,672.50	754.68	1,548.55	46,813.68

Manitowoc	30,818.41		31,858.35	2,331.88		65,008.64
Marathon	55,840.05		8,308.47	2,080.40	2,601.52	68,830.44
Marinette	27,328.40		15,030.14	1,318.89	455.75	44,133.16
Marquette	13,712.37	3,014.95	2,224.37	712.82		19,664.51
Milwaukee	28,578.36	19,886.93	22,344.03	3,540.79		74,350.11
Monroe	41,236.25	8,655.26	3,083.38	850.03	1,128.78	54,953.70
Oconto	34,454.28		5,554.24	2,248.53	2,173.37	44,430.42
Oneida	51,932.90	804.12	11,746.12	1,070.36		65,553.50
Outagamie	45,870.18		6,821.35	3,642.76	1,299.29	57,633.58
Ozaukee*	15,619.57		8,525.20	854.17	295.82	25,294.76
Pepin*	14,344.97	4,307.91	529.78	332.31		19,514.97
Pierce*	32,619.23	17,696.50	11,099.08	573.40	398.63	62,386.84
Polk	30,800.42		9,904.04	853.58	600.58	42,158.62
Portage	32,380.00	887.76	5,919.88	932.18	2,242.71	42,362.53
Price	36,191.88	3,410.07		1,135.35		40,737.30
Racine	35,107.26	27,167.69		1,318.20	824.44	64,417.59
Richland	25,909.00		10,863.47	1,518.76	792.85	39,084.08
Rock	34,862.88	966.38	18,736.98	1,566.96	1,678.08	57,811.28
Rusk	24,886.19	2,494.78	2,898.97	991.09	1,860.44	33,131.47
St. Croix*	38,647.74	14,018.94	17,069.95	1,571.66	762.76	72,071.05
Sauk	48,927.73		27,884.33	297.20	1,953.62	79,062.88
Sawyer	24,779.27		16,777.42	802.40	1,209.50	43,568.59
Shawano	36,123.45		20,479.53	2,925.96	1,335.42	60,864.36
Sheboygan*	54,567.28		16,717.34	687.79	994.58	72,966.98
Taylor*	22,650.27	8,233.61	7,274.78	924.92	732.50	39,816.08
Trempealeau	54,507.27		1,740.35	1,923.58	672.36	58,843.56
Vernon	54,337.31	2,932.92	573.03	1,521.01	1,372.86	60,737.13
Vilas	21,464.06		4,581.33			26,045.39
Walworth*	25,212.19		27,702.76	1,258.65	1,977.00	56,150.60
Washburn	27,332.12		16,758.92	1,575.88	1,108.12	46,775.04
Washington*	28,797.40	6,352.32	23,238.67	1,844.29		60,232.68
Waukesha*	26,199.93		3,309.27	3,351.41	1,200.70	34,061.31
Waupaca	38,926.38	4,093.94	9,092.64	3,235.44	2,205.11	57,553.51
Waushara	26,916.25	8,461.64	8,286.53	1,419.15		45,083.57
Winnebago	28,163.59		7,000.00	928.67		36,092.26
Wood	30,194.68	4,425.21	8,801.30	826.82		44,248.01
Menominee Indian Reservation*	5,081.81		8,085.27	231.60		13,398.68
Totals	$2,308,890.92	$428,900.07	$654,464.42	$91,930.67	$53,261.78	$3,537,447.86

* Figures not complete for these counties.

(Continued from page 187)

The answer, of course, is as follows:

(1) The high type road gives service to heavy traffic, while the earth road does not give such service.

(2) The high type road is usable to a much greater extent than the low type road.

(3) The construction of a high type road is made necessary because the low type road would be impassable under heavy traffic.

The problem is one of transportation, and the expense of constructing and maintaining highways, which form the roadbed of our highway transportation system, is only one item in that cost. By far the greatest item is the cost of purchasing and maintaining the rolling stock which operates over that roadbed. If the construction of highways is discontinued, and maintenance becomes a thing of the past, the items of expenditure connected with the roadbed will, of course, diminish; but the cost of operation will vastly increase. Those who use the roads will pay the costs just as surely but they will be paid in increased repairs for the maintenance and operation of motor vehicles. The money will go to the garage men and the tire dealers and for extra gasoline instead of being paid as taxes into the public treasury. The expenditures will be there just as surely and probably in a greater amount. Instead of paying the cost of transportation in a rational manner by providing adequate roads over which motor equipment can be operated in a satisfactory and economical way, it will be paid in an irrational manner by operating this motor equipment uneconomically over inadequate highways.

TABLE IIIa—TOTAL MAINTENANCE EXPENDITURES ON THE STATE TRUNK HIGHWAY SYSTEM 1918 TO 1923 INCLUSIVE

Year	General Maintenance	Gang Maintenance	Marking & Signing	Patrol Sup.	Total	Miles Maint.	Cost Per Mile
1918	$573,042	$396,500	$7,888		$977,430	$4,999	$195.52
1919	762,587	488,530	17,776	$4,715	1,273,608	4,999	254.77
1920	1,203,729	756,474	28,821	16,806	2,005,830	7,246	276.82
1921	1,306,465	1,028,976	25,511	20,462	2,381,414	7,260	328.02
1922	1,342,639	679,456	48,241	35,866	2,106,202	7,459	282.91
1923	1,642,246	926,192	40,296	38,221	2,646,955	7,459	355.00
1924	2,185,498	R- 419,271 B- 844,204	123,913	49,441	3,622,327	10,202	355.06
1925*	2,308,891	R- 428,900 B- 654,464	91,931	53,262	3,537,448	10,300	343.44

* 1925 figures not complete when this tabulation was made.

Under Gang Maintenance for 1924 and 1925 costs have been separated into (R) reconstruction and (B) betterments.

TABLE IV—FUNDS ALLOTTED TO TOWNS, VILLAGES, AND CITIES FOR IMPROVEMENT OF PUBLIC ROADS AND STREETS EXCLUSIVE OF S.T.H.'S., C.T.H.'S., AND CONNECTED STREETS AS PROVIDED UNDER SECTION 20.49—8 WISCONSIN STATUTE

January 1, 1926

County	Towns		Villages		Cities					Total Allotment to Tn., Vil., & Cy.
	Miles of Public Roads	Amount Allotted	Miles of Public Streets	Amount Allotted	Miles of Public Streets				Amounts	
					At $200.00	At $150.00	At $100.00	At $50.00		
Adams	991.75	$24,793.75	21.01	$525.25						$25,319.00
Ashland	453.13	11,328.25	4.3	107.50			50.32	9.0	$5,482.00	16,917.75
Barron	1,253.05	31,326.25	16.11	402.75				57.39	2,869.50	34,598.50
Bayfiled	1,016.45	25,411.25	2.07	51.75				41.6	2,080.00	27,543.00
Brown	860.85	21,521.25	17.10	427.50			114.217	25.36	12,689.70	34,638.45
Buffalo	639.18	15,979.50	0.88	22.00				31.03	1,551.50	17,563.00
Burnett	1,049.75	26,243.75	14.51	362.75						26,606.50
Calumet	471.2	11,780.00	19.31	482.75				11.71	585.50	12,848.25
Chippewa	1,108.18	27,704.50	27.39	684.75				80.53	4,029.00	32,418.25
Clark	1,588.19	39,704.75	28.63	715.75				39.55	1,977.50	42,398.00
Columbia	995.65	24,891.25	44.93	1,123.25				46.18	2,309.00	28,323.50
Crawford	586.33	14,658.25	34.85	871.25				33.90	1,695.00	17,224.50
Dane	1,497.44	37,436.00	62.83	1,570.75			121.57	17.43	13,028.50	52,035.25
Dodge	1,099.67	27,491.75	24.41	610.25				87.54	4,377.00	32,479.00
Door	676.75	16,918.75	15.55	388.75				30.98	1,549.00	18,856.50
Douglas	956.2	23,905.00	52.48	1,312.00		164.17			24,625.50	49,842.50
Dunn	1,047.24	26,181.00	25.62	640.50				38.0	1,900.00	28,721.50
Eau Claire	687.05	17,176.25	8.0	200.00			107.33	16.21	11,543.50	28,919.75
Florence	187.58	4,689.50								4,689.50
Fond du Lac	951.96	23,799.00	28.84	721.00			76.98	30.20	9,208.00	33,728.00
Forest	297.78	7,444.50						22.26	1,113.00	8,557.50
Grant	1,403.76	35,094.00	49.87	1,246.75				81.02	4,051.00	40,391.75
Green	830.25	20,756.25	22.49	562.25				51.38	2,569.00	23,887.50
Green Lake	385.25	9,631.25	11.98	299.50				41.11	2,055.50	11,988.25
Iowa	854.76	21,369.00	29.32	733.00				33.12	1,656.00	23,758.00

TABLE IV (Continued)

County	Towns		Villages		Cities					Total Allottment to Tn., Vil., & Cy.
	Miles of Public Roads	Amount Allotted	Miles of Public Streets	Amount Allotted	Miles of Public Streets					
					At $200.00	At $150.00	At $100.00	At $50.00	Amounts	
Iron	209.09	$5,227.25						16.57	$828.50	$6,055.75
Jackson	963.42	24,085.50	16.20	$405.00				10.47	523.50	25,014.00
Jefferson	699.19	17,479.75	19.05	476.25				81.89	4,094.50	22,050.50
Juneau	948.05	23,701.25	24.70	617.50				31.34	1,567.00	25,885.75
Kenosha	261.29	6,532.25				117.34			17,601.00	24,133.25
Kewaunee	487.9	12,197.50	2.71	67.75				23.12	1,156.00	13,421.25
La Crosse	323.59	8,089.75	11.95	298.75			106.264	8.68	11,060.40	19,448.90
Lafayette	675.67	16,891.75	22.40	560.00				20.13	1,006.50	18,458.25
Langlade	532.5	13,312.50						40.76	2,038.00	15,350.50
Lincoln	549.27	13,731.75						59.9	2,995.00	16,726.75
Manitowoc	1,001.4	25,035.00	4.5	112.50			74.79	27.46	8,852.00	33,999.50
Marathon	1,990.4	49,760.00	53.91	1,347.75			94.2	0.5	9,445.00	60,552.75
Marinette	1,058.98	26,474.50	21.73	543.25			53.51	13.23	6,012.50	33,030.25
Marquette	623.64	15,591.00	18.03	450.75						16,041.75
Milwaukee	446.65	11,166.25	43.42	1,085.50	548.50		51.59	118.68	120,793.00	133,044.75
Monroe	974.17	24,354.25	15.17	379.25				36.99	1,849.50	26,583.00
Oconto	986.24	24,656.00	10.2	255.00				40.85	2,042.50	26,953.50
Oneida	700.33	17,508.25						23.53	1,176.50	18,684.75
Outagamie	768.12	19,203.00	40.56	1,014.00			70.33	36.09	8,837.50	29,054.50
Ozaukee	303.63	7,590.75	9.77	244.25				22.36	1,118.00	8,953.00
Pepin	291.98	7,299.50	11.51	287.75				9.56	478.00	8,065.25
Pierce	791.10	19,777.50	21.97	549.25				28.62	1,431.00	21,757.75
Polk	1,255.25	31,381.25	57.5	1,437.50				8.04	402.00	33,220.75
Portage	1,204.10	30,102.50	19.74	493.50			53.6		5,360.00	35,956.00
Price	625.76	15,644.00	14.87	371.75				24.60	1,230.00	17,245.75
Racine	413.74	10,343.50	9.16	229.00		119.14		18.42	18,792.00	29,364.50
Richland	822.20	20,555.00	17.7	442.50				16.45	822.50	21,820.00
Rock	820.74	20,518.50	8.92	223.00			131.08	19.69	14,092.50	34,834.00
Rusk	682.65	17,066.25	25.7	642.50				19.75	987.50	18,696.25
St. Croix	1,027.82	25,695.50	26.38	659.50				33.20	1,660.00	28,015.00

Sauk	1,043.43	26,085 75	38.35	958.75				33.67	1,683.50	28,728.00
Sawyer	590.70	14,767.50	7.15	178.75				6.0	300.00	15,246.25
Shawano	1,037.63	25,940.75	40.09	1,002.25				19.6	980.00	27,923.00
Sheboygan	682.6	17,065.00	26.77	669.25			81.90	17.31	9,055.50	26,789.75
Taylor	829.8	20,745.00	15.2	380.00				13.8	690.00	21,815.00
Trempealeau	809.04	20,226.00	37.0	925.00				6.0	300.00	21,451.00
Vernon	1,074.37	26,859.25	25.44	636.00				20.09	1,004.50	28,499.75
Vilas	429.07	10,726.75	7.25	181.25						10,908.00
Walworth	661.2	16,530.00	38.13	953.25				66.7	3,335.00	20,818.25
Washburn	744.0	18.600.00	21.0	525.00				14.0	700.00	19,825.00
Washington	643.65	16,091.25	10.38	259.50				25.46	1,273.00	17,623.75
Waukesha	634.69	15,867.25	29.73	743.25			42.88	17.73	5,174.50	21,785.00
Waupaca	872.50	21,812.50	39.09	977.25				49.62	2,481.00	25,270.75
Waushara	972.97	24,324.25	28.95	723.75						25,048.00
Winnebago	614.6	15,365.00	22.40	560.00			91.20	53.37	11,788.50	27,713.50
Wood	945.64	23,641.00	24.47	611.75				97.23	4,861.50	29,114.25
Totals	56,914.16	$1,422,854.00	1,501.63	$ 37,540.75	548.5	400.65	1,321.761	2,057.01	$404,824.10	$1,865,218.85

RECAPITULATION

56,914.16	Miles Public Roads in Towns	$25.00	$ 1,422,854.00
1,501.63	Miles Public Streets in Villages	25.00	37,540.75
548.5	Miles Public Streets in Cities	200.00	109,700.00
400.65	Miles Public Streets in Cities	150.00	60,097.50
1,321.761	Miles Public Streets in Cities	100.00	132,176.10
2,057.01	Miles Public Streets in Cities	50.00	102,850.50
62,743.711	Miles		$ 1,865,218.85

TABLE V—CLASSIFICATION OF STATE TRUNK HIGHWAYS BY COUNTIES IN 1918–1921 AND 1924

The 1918 classification shows the original 5,000 mile system immediately after being taken over for maintenance.
The 1921 classification shows the 7,457.47 miles of the 7,500 mile system of 1919 maintained in 1921.
The 1924 classification shows the 9,480.07 miles of the 10,000 mile system of 1923 maintained in 1924.

It is to be noted that the percentage of concrete pavement has increased steadily. The percentage of gravel roads increased from 1918 to 1921, and decreased slightly from 1921 to 1924. The percentage of earth roads decreased very decidedly from 1918 to 1921, and slightly from 1921 to 1924.

The mileage of surfaced roads, maintained as State Trunk Highways, has increased steadily.

County	Concrete			Gravels—Incl. Macadam, Mine T'l'g's, Shales, etc.			Earth Road			Totals		
	1918	1921	1924	1918	1921	1924	1918	1921	1924	1918	1921	1924
Adams	.25			3.95	46.88	5.80	69.98	33.68	54.15	74.18	80.56	59.95
Ashland				30.20	77.39	91.10	54.36	17.40	17.00	84.56	94.79	108.10
Barron				3.65	94.31	92.40	87.31	13.37	16.40	90.96	107.68	108.80
Bayfield		.10		2.21	60.27	50.10	93.80	89.70	85.30	96.01	150.07	135.40
Brown	4.61	38.59	103.10	47.65	82.42	40.48	17.85	7.17	4.40	70.11	128.18	147.98
Buffalo	.20	.62		11.39	43.10	61.00	87.69	66.64	76.00	99.28	110.36	137.00
Burnett				1.00	38.90	22.00	38.41	30.38	58.50	39.41	69.28	80.50
Calumet	1.00	9.11	7.00	31.40	57.79	70.50	30.75	17.64	9.15	63.15	84.54	86.65
Chippewa		5.89	5.90	48.95	65.55	112.50	37.37	48.21	51.43	86.32	119.65	169.83
Clark		.21		20.83	93.78	127.60	59.70	19.33	21.90	80.53	113.32	149.50
Columbia	.50	.65		55.70	113.16	170.36	42.04	40.42	37.60	98.24	154.23	207.96
Crawford				2.55	21.09	9.50	63.40	67.95	119.80	65.95	89.04	129.30
Dane	5.20	10.09	14.50	75.42	146.94	225.90	76.92	46.70	40.00	157.54	203.73	280.40
Dodge	1.50	27.16	111.80	47.25	90.13	75.20	46.39	52.02	37.90	95.14	169.31	224.90
Door			3.90	40.03	63.90	82.10	.80			40.83	63.90	86.00
Douglas		5.70	12.30	17.83	49.75	62.70	44.56	42.70	32.30	62.39	98.15	107.30
Dunn		4.09	4.10	10.78	48.30	65.30	32.00	60.73	80.90	42.78	113.12	150.30
Eau Claire	2.90	6.67	7.50	21.35	72.34	94.54	58.90	8.62	12.06	83.15	87.63	114.10
Florence				20.50	27.95	37.70	13.85	6.35	5.20	34.35	34.30	42.90
Fond du Lac	2.90	26.29	97.80	51.74	93.46	49.70	29.54	29.03	28.60	84.18	148.78	176.10
Forest					18.01	15.00	63.44	88.96	95.20	63.44	106.97	110.20
Grant	.10	1.50	1.90	25.16	85.19	133.90	85.90	108.05	95.70	111.16	194.74	231.50
Green	2.94	12.37	36.10	30.81	37.26	62.20	22.74	27.80	17.00	56.49	77.43	115.30
Green Lake		8.25	9.50	22.60	42.05	56.20	24.16	6.00	5.40	46.76	56.30	71.10
Iowa		.63		2.98	33.47	66.20	63.14	47.95	78.60	66.12	82.05	144.80
Iron				2.20	24.60	38.30	51.56	46.65	41.20	53.76	71.25	79.50
Jackson	1.86	6.73	3.80	3.00	30.91	85.90	60.74	62.62	48.05	65.60	100.26	137.75
Jefferson	.70	12.83	74.20	58.83	116.91	73.10	19.61	8.01	11.20	79.14	137.75	158.50
Juneau	.50	1.85		17.03	47.29	36.90	67.79	37.78	84.80	85.32	86.92	121.70
Kenosha	9.55	29.10	42.80	22.42	17.40	28.50	3.70	7.50	6.60	35.67	54.00	77.90

Kewaunee	.50	1.65		49.82	66.71	81.24	2.00	.70	106.00	52.32	69.06	187.24
La Crosse		.79		30.44	69.34	83.90	18.50	13.55	14.10	48.94	83.68	98.00
Lafayette		.90		4.10	32.00	60.40	62.66	77.97	67.20	66.76	110.87	127.60
Langlade				1.60	30.45	33.40	30.58	56.65	72.00	32.18	87.10	105.40
Lincoln				8.89	38.08	74.30	32.47	50.42	65.20	41.36	88.50	139.50
Manitowoc	3.20	12.66	14.60	62.80	81.70	161.25	9.70	1.23	0.85	75.70	95.59	176.70
Marathon		4.47	9.30	20.55	81.45	77.50	87.11	52.90	68.10	107.66	138.82	154.90
Marinette		4.57	3.90	40.55	70.64	111.00	20.65	19.00	12.30	61.20	94.21	127.20
Marquette	.15	.75		13.65	42.84	49.00	27.19	6.65	12.60	40.99	50.24	61.60
Milwaukee	50.46	64.33	96.20	15.88	14.55	5.20	3.04			69.38	78.88	101.40
Monroe	.35	.13	3.90	19.21	41.41	38.60	55.57	78.14	111.30	75.13	119.68	153.80
Oconto				25.90	81.52	87.00	41.70	67.24	28.67	67.60	148.76	115.67
Oneida				4.94	81.97	39.20	111.14	72.15	110.30	116.08	154.12	149.50
Outagamie		59.52	95.70	40.96	41.73	44.50	9.45	3.70	6.30	50.41	104.95	146.50
Ozaukee		8.15	32.70	32.70	48.17	42.90	1.80	3.00		34.50	59.32	75.60
Pepin				10.80	22.50	34.20	16.10	12.36	10.11	26.90	34.86	44.31
Pierce	.20	.50		10.00	48.31	92.55	43.22	38.64	59.45	53.42	87.45	152.00
Polk				8.30	80.88	121.70	63.72	8.17	10.75	72.02	89.05	132.45
Portage	.30	7.75	12.00	23.78	90.81	65.50	53.67	27.12	63.20	77.75	125.68	140.70
Price				3.95	39.79	58.30	79.29	90.23	76.20	83.24	130.02	134.50
Racine	6.96	40.70	80.70	41.16	28.19	35.40	17.69	2.65	4.00	65.81	71.54	120.10
Richland	.50	3.63	5.20	26.35	41.65	27.00	51.19	42.98	92.50	78.04	88.26	124.70
Rock	1.60	23.48	54.20	65.21	115.20	121.40	12.55		4.10	79.36	138.68	179.70
Rusk				10.50	48.55	23.70	64.78	36.85	68.70	75.28	85.40	92.40
St. Croix	.10	3.41	4.10	23.70	66.96	104.60	45.07	54.30	58.28	68.87	124.67	166.98
Sauk	2.10	5.32	5.15	61.99	119.81	145.60	42.46	11.52	67.15	106.55	136.65	217.90
Sawyer					11.25	47.90	61.14	80.71	75.50	61.14	91.96	123.40
Shawano	.10			28.25	115.92	127.40	74.05	47.12	65.40	102.40	163.04	192.80
Sheboygan	7.30	18.35	20.10	54.19	84.30	127.40	7.20	2.95	5.60	68.69	105.60	153.10
Taylor				5.25	33.95	57.10	21.27	47.05	55.50	26.52	81.00	112.60
Trempealeau	.45	.43		23.73	64.27	106.70	67.09	61.51	56.90	91.27	126.21	163.60
Vernon		.10	8.40	2.95	8.28	8.60	58.83	119.07	162.30	61.78	127.45	179.30
Vilas				5.33	70.34	23.30	54.53	21.65	75.80	59.86	91.99	99.10
Walworth	.85	31.01	78.50	74.85	112.14	68.20	14.36	.25		90.06	143.40	146.70
Washburn				1.10	56.98	32.50	74.55	29.56	57.20	75.65	86.54	89.70
Washington		22.24	60.80	49.56	49.33	66.10	13.00			62.56	71.57	126.90
Waukesha		51.72	118.90	61.03	112.16	84.60	10.78			71.81	163.88	203.50
Waupaca	.80	7.65	25.00	49.24	115.99	100.10	31.53	14.15	39.80	81.57	137.79	164.90
Waushara	.90	1.28		40.24	78.33	73.60	57.60	39.96	37.00	98.74	119.57	110.60
Winnebago	2.70	31.45	63.00	26.55	44.26	62.10	9.80	2.35		39.05	78.06	125.10
Wood	6.20	33.78	69.50	4.04	26.40	3.80	57.77	24.90	37.90	68.01	85.08	111.20
Total mileage	120.43	649.15	1,398.05	1,813.45	4,349.61	4,951.42	3,065.20	2,458.71	3,130.60	4,999.08	7.457.47	9,480.07
Percentages	2.4	6.7	14.7	36.2	58.3	52.1	61.4	34.0	33.2	100.00	100.00	100.00

* 1924 figures do not include 619.35 miles which were not open as State Trunk Highways in 1924.

TABLE Va—CLASSIFICATION OF STATE TRUNK HIGHWAYS BY TYPES OF COUNTIES AT END OF 1925

County	ALL S. T. HIGHWAYS												Remarks
	Conc. or Equiv.	Bit. Mac. adam	Stone Mac-adam	Grav. Surf. Treated	Gravel	Miscellaneous					City	Total	
						Mine Tail'gs	Disint. Granite	Shale	Sand Clay	Earth			
Adams	0.2				37.9				31.9	22.8		92.8	
Ashland	0.7			2.0	100.2					17.4	3.9	124.2	
Barron				1.3	109.1					24.4	2.0	136.8	
Bayfield	1.1		1.6		48.5			8.1	58.5	34.5	1.0	153.3	*Top Soil
Brown	113.8		2.8		44.0						9.3	170.0	
Buffalo	3.5		0.8	5.4	31.1	0.7		29.4		65.3		136.2	*Cinders
Burnett					50.5					42.5		93.0	
Calumet	8.8		8.2	0.1	80.3					3.2		100.6	
Chippewa	5.8			0.4	149.5	1.2		0.2		15.2	4.1	176.4	*Cinders
Clark	3.7				101.0		33.6	7.5		18.4		164.2	
Columbia	5.3		6.8	46.7	146.0			2.6		20.8	3.1	231.3	*Includes 0.3 Crossing Ferry
Crawford	0.3				19.6	1.2		6.7		100.2	2.6	130.6	*Cinders
Dane	28.6	5.7	9.3	137.0	123.9			5.3		29.6	18.4	357.8	
Dodge	180.9			9.9	27.0					18.3	8.1	244.2	
Door	4.5		12.1	2.4	71.9						1.6	92.5	
Douglas	12.3				77.6				10.0	34.6	13.2	147.7	
Dunn	5.9			0.1	90.1			8.4		68.7	2.8	176.0	
Eau Claire	7.5			15.3	90.0			7.9		3.0	6.3	130.0	
Florence					34.4					12.0		46.4	
Fond du Lac	130.9			1.1	50.7						11.6	194.3	
Forest					21.4					111.1		132.5	
Grant	2.9	0.2	8.3	18.4	* 106.3	37.2		11.6	0.8	47.4	3.1	236.2	*Includes much crushed l'stone
Green	55.6		0.3	0.5	60.7					18.4	3.7	139.2	
Green Lake	9.2	2.6	0.1	6.4	52.1						1.9	72.3	
Iowa			2.0	3.7	40.0	13.6		21.2		68.9	1.4	152.5	*Incl. 2.3—no Surf. shown
Iron					61.1					19.0	2.5	82.0	
Jackson	7.7				20.3			78.1	4.0	58.6		168.7	
Jefferson	81.0			2.8	87.3						9.1	180.2	
Juneau	3.8		6.7	1.2	38.4			10.6	0.8	63.3		124.8	
Kenosha	50.4				27.8						5.5	83.7	

Kewaunee	1.6			2.8	81.0							85.4	
La Crosse	0.8	82.8		6.5				3.8		14.6	9.7	118.2	
Lafayette	2.8	2.8	2.4	3.8	* 45.5	11.6		27.3		34.4		130.6	*Incl. crushed stone
Langlade					46.2		0.9			* 72.8	3.8	123.7	*Incl. some poor thin gravel
Lincoln					94.6					54.3	6.5	155.4	
Manitowoc	22.2		1.3	2.6	155.7						6.0	187.8	
Marathon	28.2		0.8		45.3		54.5		1.6	82.9	5.8	219.1	
Marinette			1.8	5.7	110.7	0.1				11.4	2.7	138.5	*Cinders
Marquette			2.7	0.6	54.4					7.3		65.1	
Milwaukee	117.4				1.8						35.5	154.7	
Monroe	3.3	1.9	8.3	1.7	24.0	* 2.9		31.9		95.8	5.8	175.6	*Cinders
Oconto	2.8			12.0	95.9	* 0.4	5.4			52.2	3.2	171.9	*Cinders
Oneida					59.3					116.1	4.8	180.2	
Outagamie	92.5		3.1	4.0	52.8	* 0.3				9.0	9.0	170.6	*Cinders
Ozaukee	41.9	5.8		7.1	26.7						2.2	83.7	
Pepin	0.4			2.4	40.6			1.3		21.3		66.0	
Pierce	0.6		0.5	2.7	106.9				0.8	48.1		159.6	
Polk					127.8					17.0		144.8	
Portage	20.3		10.6		71.9		6.7			31.0	4.1	144.6	
Price					94.2					55.8	0.7	150.7	
Racine	93.4			0.4	29.6						13.5	136.9	
Richland	6.7	0.2	0.8	16.9	28.3			16.0		61.5	2.1	132.5	
Rock	90.8			3.1	107.4					1.7	14.5	217.5	
Rusk					59.6	* 3.6				45.4	1.7	110.3	*Cinders
St. Croix	3.7			6.7	135.9					25.2	1.9	173.4	
Sauk	12.6	0.5	25.1	34.9	103.4			4.4		46.1	6.8	233.8	
Sawyer	0.4				67.5			0.3	* 7.6	59.4		135.2	*Top Soil
Shawano	5.8	0.2			105.8		9.8		0.1	27.7	2.3	151.7	
Reservation					18.6					24.4		43.0	
Sheboygan	36.8	3.7		19.6	98.6						8.4	167.1	
Taylor				1.9	107.9		3.1			1.9		114.8	
Trempealeau	0.9	1.4		13.0	75.6			24.3		57.8		173.0	
Vernon	7.7	3.4	1.6	3.5	3.1	* 2.1		4.8		** 159.3	2.4	187.9	*Cinders **Oiled
Vilas	0.2				38.1				4.3	58.0		100.6	
Walworth	108.3			0.9	41.7						7.3	158.2	
Washburn					72.9					52.0		124.9	
Washington	76.8	0.4		0.3	55.8						4.8	138.1	
Waukesha	139.3		2.0	0.8	78.0						5.8	225.9	
Waupaca	23.1		14.8	0.5	115.3					19.5	4.6	177.8	
Waushara	1.1		9.9		94.5				5.0	12.9		123.4	
Winnebago	75.3			0.2	47.3	* 1.5				2.3	12.1	138.7	
Wood	71.4		1.0	1.5	15.4				26.6	25.4	5.6	146.9	*Cinders
Totals	1,821.5	111.6	145.7	410.8	4,834.4	76.4	114.0	311.7	152.0	2,322.1	308.7	10,608.8	

TABLE Vb—CLASSIFICATION OF STATE TRUNK HIGHWAYS BY TYPES AND BY DIVISIONS AT END OF 1925

Div. No.	Conc. or Equiv.	Bit. Mac-adam	Stone Mac-adam	Grav. Surf. Treat.	Gravel	Miscellaneous					Totals
						Mine Tail.	Disin. Gran.	Shale	Sand Clay	Earth	
1	454.9	6.2	41.5	234.9	655.7	------	------	12.3	------	134.9	1,540.4
2	795.2	9.9	2.0	30.2	410.7	------	------	------	------	------	1,248.0
3	333.4	0.2	29.3	29.8	864.1	2.3	15.2	------	0.1	130.2	1,404.5
4	157.4	2.6	46.6	10.2	525.2	------	61.2	10.6	65.9	265.1	1,144.8
5	23.9	89.5	10.7	30.1	154.1	5.7	------	172.3	4.0	451.4	941.7
6	27.6	------	0.5	29.5	821.9	1.2	36.7	25.3	0.8	201.8	1,145.3
7	0.2	------	------	------	449.3	------	0.9	------	4.3	499.1	953.8
8	14.5	------	1.6	3.3	713.7	3.6	------	8.4	76.1	327.2	1,148.4
9	14.4	3.2	13.5	42.8	239.7	63.6	------	82.8	0.8	312.4	773.2
	1,821.5	111.6	145.7	410.8	4,834.4	76.4	114.0	311.7	152.0	2,322.1	10,300.1

TABLE VI—STATE AID ALLOTTED TO COUNTIES FOR CONSTRUCTION—YEARS 1912 TO 1925 INCLUSIVE

County	Total Allotment for the Years 1912 to 1919, inclusive	Allotment for 1920	Allotment for 1921	Allotment for 1922	Allotment for 1923	Allotment for 1924	Allotment for 1925	Total 1912 to 1925
Adams	$ 18,420.23	$ 2,243.37	$ 2,070.20	$ 2,051.70	$ 1,965.96	$ 1,848.88	$ 1,628.21	$30,228.55
Ashland	79,295.52	4,690.38	4,752.16	4,633.91	4,488.89	4,208.02	4,076.49	106,145.37
Barron	65,966.96	8,531.57	9,180.10	9,180.59	9,362.66	9,297.63	9,038.58	120,558.09
Bayfield	43,749.20	4,821.57	5,171.01	5,104.61	4,898.39	4,650.01	4,041.82	72,436.61
Brown	139,492.93	14,949.57	15,352.94	15,544.06	15,260.30	15,317.54	15,511.83	231,429.17
Buffalo	51,414.58	5,320.97	5,433.13	5,325.53	5,168.43	4,917.45	4,877.41	82,457.50
Burnett	17,481.04	2,358.41	2,524.21	2,485.94	2,493.53	2,478.61	2,376.12	32,197.86
Calumet	48,614.80	7,199.63	6,928.84	7,048.38	7,003.33	6,753.67	6,624.51	90,173.16
Chippewa	79,034.74	9,294.14	9,822.74	9,772.82	9,842.97	9,866.35	9,586.69	137,220.45
Clark	79,401.56	9,688.41	10,206.57	10,063.58	10,090.96	10,036.14	9,578.60	139,065.82
Columbia	126,434.88	11,895.18	11,884.09	11,588.31	11,428.34	11,140.75	10,379.09	194,750.64
Crawford	35,486.58	4,961.68	5,043.08	4,809.54	4,828.25	4,692.01	4,436.38	64,257.52
Dane	337,391.29	39,156.88	38,865.71	38,926.41	38,756.42	38,818.26	39,539.38	571,454.35
Dodge	181,369.65	21,127.22	21,062.06	20,923.78	20,821.39	20,438.30	19,435.97	305,178.37
Door	56,658.32	4,591.78	4,574.05	4,517.29	4,499.55	4,483.31	4,286.37	83,610.67
Douglas	125,563.85	13,783.34	13,882.54	13,888.82	13,855.39	13,428.24	12,547.94	206,950.12
Dunn	58,994.33	8,258.29	8,683.67	8,424.52	8,389.58	8,274.95	8,156.30	109,181.64
Eau Claire	53,576.22	8,365.46	8,687.63	8,743.80	9,005.66	8,923.25	9,234.36	106,536.38
Florence	20,018.74	979.01	1,026.75	996.60	1,045.05	1,039.82	1,022.93	26,128.90
Fond du Lac	129,297.11	17,786.14	17,365.57	17,643.73	17,372.79	17,570.67	17,393.53	234,429.54
Forest	48,146.92	3,082.57	2,975.64	2,874.28	2,984.31	2,857.75	2,646.28	65,567.75
Grant	157,026.42	16,803.16	16,938.31	16,389.62	16,104.89	16,002.75	14,359.52	253,624.67
Green	130,743.89	11,506.57	10,958.37	10,843.06	10,718.42	10,432.86	9,892.07	195.095.24
Green Lake	48,532.35	5,839.45	5,603.01	5,465.08	5,451.43	5,319.97	4,877.60	81,088.89
Iowa	80,117.36	11,357.55	11,278.23	10,882.36	10,677.17	10,461.11	9,338.75	144,112.53
Iron	43,015.51	2,772.31	2,667.56	2,837.72	2,712.05	2,729.61	2,880.79	59,615.55
Jackson	55,488.00	4,937.79	5,097.77	4,937.00	4,978.84	4,756.98	4,017.14	84,213.52
Jefferson	129,720.04	13,773.52	13,189.38	13,324.08	12,945.08	12,731.01	12,326.57	203,919.68
Juneau	56,108.59	4,634.24	4,664.22	4,580.22	4,412.92	4,318.60	3,770.65	82,489.44
Kenosha	115,202.72	13,599.96	14,154.79	14,932.36	15,493.63	15,666.24	18,476.21	207,525.91
Kewaunee	49,234.04	5,407.19	5,178.04	5,147.88	5,126.32	5,019.79	4,823.50	79,936.76
La Crosse	118,573.03	10,587.74	10,877.38	10,884.36	11,020.33	10,707.04	11,061.13	183,711.01
Lafayette	96,186.70	11,388.14	10,856.54	10,465.19	10,351.23	9,894.56	9,378.43	158,520.79
Langlade	44,993.69	4,729.43	4,864.06	4,850.44	4,690.59	4,693.84	4,481.79	73,303.84
Lincoln	52,280.52	4,875.45	5,093.17	5,081.06	4,978.63	4,900.07	4,777.67	81,986.57

TABLE VI (Continued)

County	Total Allotment for the Years 1912 to 1919, inclusive	Allotment for 1920	Allotment for 1921	Allotment for 1922	Allotment for 1923	Allotment for 1924	Allotment for 1925	Total 1912 to 1925
Manitowoc	$118,815.32	$15,451.26	$15,407.04	$15,540.03	$15,625.80	$15,627.47	$15,805.02	$212,271.94
Marathon	119,693.39	16,106.39	16,464.10	16,557.53	16,122.05	16,072.01	15,893.59	216,909.06
Marinette	73,682.66	6,179.39	5,928.23	5,959.19	6,006.36	5,732.74	5,779.29	109,267.86
Marquette	31,288.39	2,968.95	2,892.00	2,744.05	2,680.15	2,467.55	2,073.47	47,114.56
Milwaukee	1,290,450.97	150,505.48	145,481.45	147,860.56	150,503.29	157,866.39	173,656.31	2,216,324.45
Monroe	87,651.47	8,020.93	7,749.52	7,340.14	7,326.01	7,068.95	6,538.34	131,695.36
Oconto	51,044.83	5,408.56	5,495.49	5,382.29	5,227.47	5,206.13	5,044.08	82,808.85
Oneida	40,717.29	3,380.65	3,471.14	3,600.30	3,558.96	3,498.20	3,466.17	61,692.71
Outagamie	109,052.63	14,999.79	14,878.07	15,285.21	14,901.62	15,581.37	15,805.82	200,504.51
Ozaukee	43,314.05	5,916.29	5,783.77	5,626.85	5,593.85	5,499.92	5,350.87	77,085.60
Pepin	15,739.15	2,139.20	2,154.30	2,137.55	2,138.55	2,042.48	1,938.46	28,289.69
Pierce	59,708.72	6,674.58	7,047.15	6,917.51	6,757.65	6,610.61	6,190.89	99,907.11
Polk	62,697.42	7,309.40	7,830.21	7,728.75	7,668.93	7,558.52	7,066.52	170,859.75
Portage	77,447.83	6,490.37	6,235.46	6,209.66	6,262.65	6,138.30	5,652.71	114,436.98
Price	41,391.32	3,747.85	3,870.65	3,824.72	3,741.40	3,681.12	3,118.69	63,375.75
Racine	149,166.55	21,899.55	23,446.02	23,574.28	24,574.87	24,867.72	26,318.80	293,847.79
Richland	79,133.66	7,984.51	8,160.57	7,714.93	7,706.17	7,513.12	6,597.70	124,810.66
Rock	195,257.58	21,287.15	21,983.06	22,775.28	22,870.31	22,574.00	22,515.71	329,263.09
Rusk	44,637.46	3,536.25	3,640.01	3,751.65	3,803.67	3,586.88	3,624.19	66,680.11
St. Croix	63,288.26	8,729.01	8,995.49	8,930.19	8,709.78	8,495.20	7,611.09	114,759.02
Sauk	150,862.12	12,491.77	12,235.69	12,016.43	11,794.05	11,477.27	10,572.83	221,450.16
Sawyer	20,860.22	2,481.92	2,407.65	2,487.26	2,485.37	2,370.58	2,315.79	35,408.79
Shawano	67,701.63	7,656.62	7,723.77	7,615.18	7,362.27	7,161.99	6,781.55	112,003.01
Sheboygan	140,347.48	18,015.93	18,348.65	18,214.98	18,445.32	18,622.82	18,998.22	250,993.40
Taylor	36,583.91	3,914.25	4,088.70	4,047.84	4,065.74	4,046.38	3,527.03	60,273.85
Trempealeau	78,249.53	7,228.93	7,588.89	7,437.88	7,176.83	7,020.02	6,554.28	121,256.36
Vernon	80,695.80	9,057.25	8,869.15	8,323.43	8,277.74	8,126.23	7,729.93	131,079.53
Vilas	39,817.58	1,510.39	1,475.31	1,570.09	1,631.76	1,657.72	1,821.23	49,484.08
Walworth	115,111.11	13,694.95	13,410.52	13,412.10	13,332.90	13,211.89	12,952.18	195,125.65
Washburn	21,022.37	2,624.73	2,826.78	2,840.82	2,836.11	2,675.47	2,352.00	37,178.28
Washington	65,935.95	9,526.94	9,537.41	9,422.14	9,349.23	9,280.48	8,545.16	121,597.31
Waukesha	109,647.65	14,011.13	13,969.17	13,914.22	14,110.92	14,124.71	13,678.58	193,456.38
Waupaca	96,348.44	9,358.44	9,259.86	9,241.73	8,964.67	9,051.04	8,314.77	150,538.95
Waushara	52,710.84	4,434.12	4,273.71	4,125.12	4,124.08	3,961.12	3,515.23	77,144.22
Winnebago	114,924.07	16,823.62	16,784.45	17,444.25	17,640.84	17,452.70	17,928.17	218,998.10
Wood	85,219.55	8,135.38	8,373.04	8,347.23	8,398.95	8,394.86	8,484.72	135,353.73
Totals	$7,003,249.51	$785,000.00	$785,000.00	$785,000.00	$785,000.00	$785,000.00	$785,000.00	$11,713,249.51

TABLE VIa—ALLOTMENT OF FEDERAL AID, STATE AID AND COUNTY TRUNK IMPROVEMENTS UNDER SEC. 20.49—FISCAL YEAR ENDING JUNE 30, 1926

County	Pro Rata Share	Allotment of Residue to State and Co. Trunk Highways [Sec. 84.03(9)]	Improvement of County Trunk High-Way System 20%	Construction of S. T. Highway System		
				Total 80%	Federal Aid	State Aid
Adams	0.99	$59,046.25	$11,809.25	$47,237.00	$47,237.00	------------
Ashland	0.65	38,768.75	7,753.75	31,015.00	------------	$31,015.00
Barron	1.78	106,165.00	21,233.00	84,932.00	84,932.00	------------
Bayfield	0.89	53,082.50	10,616.50	42,466.00	42,466.00	------------
Brown	1.73	103,183.75	20,636.75	82,547.00	------------	82,547.00
Buffalo	1.06	63,222.50	12,644.50	50,578.00	50,578.00	------------
Burnett	1.09	65,011.25	13,002.25	52,009.00	52,009.00	------------
Calumet	0.81	48,311.25	9,662.25	38,649.00	38,649.00	------------
Chippewa	1.56	93,043.75	18,608.75	74,435.00	43,435.00	31,000.00
Clark	1.81	107,955.00	21,591.00	86,364.00	59,000.00	27,364.00
Columbia	1.57	93,640.00	18,728.00	74,912.00	------------	74,912.00
Crawford	1.08	64,415.00	12,883.00	51,532.00	------------	51,532.00
Dane	3.63	216,506.25	43,301.25	173,205.00	173,205.00	103,541.00
Dodge	2.17	129,426.25	25,885.25	103,541.00	------------	------------
Door	1.06	63,222.50	12,644.50	50,578.00	50,578.00	------------
Douglas	1.31	78,132.50	15,626.50	62,506.00	62,506.00	------------
Dunn	1.59	94,833.75	18,966.75	75,867.00	55,000.00	20,867.00
Eau Claire	1.32	78,728.75	15,745.75	62,983.00	------------	62,983.00
Florence	0.24	14,315.00	2,863.00	11,452.00	11,452.00	------------
Fond du Lac	2.02	120,480.00	24,096.00	96,384.00	96,384.00	------------
Forest	0.42	25,050.00	5,010.00	20,040.00	------------	20,040.00
Grant	2.32	138,372.50	27,674.50	110,698.00	50,000.00	60,698.00
Green	1.31	78,132.50	15,626.50	62,506.00	62,506.00	------------
Green Lake	0.70	41,750.00	8,350.00	33,400.00	33,400.00	------------
Iowa	1.24	73,957.50	14,791.50	59,166.00	35,000.00	24,166.00
Iron	0.26	15,507.50	3,101.50	12,406.00	12,406.00	------------
Jackson	1.42	84,693.75	16,938.75	67,755.00	------------	67,755.00
Jefferson	1.41	84,097.50	16,819.50	67,278.00	67,278.00	------------
Juneau	1.21	72,168.75	14,433.75	57,735.00	------------	57,735.00
Kenosha	1.10	65,607.50	13,121.50	52,486.00	52,486.00	------------
Kewaunee	0.82	48,907.50	9,781.50	39,126.00	10,000.00	29,126.00
La Crosse	1.30	77,536.25	38,768.25	38,768.00	------------	38,768.00
Lafayette	1.23	73,361.25	14,672.25	58,689.00	11,000.00	47,689.00
Langlade	0.85	50,697.50	10,139.50	40,558.00	40,558.00	------------
Lincoln	0.88	52,486.25	10,497.25	41,989.00	------------	41,989.00
Manitowoc	1.84	109,743.75	21,948.75	87,795.00	87,795.00	------------
Marathon	2.64	157,458.75	31,491.75	125,967.00	------------	125,967.00
Marinette	1.45	86,482.50	17,296.50	69,186.00	69,186.00	------------
Marquette	0.74	44,136.25	8,827.25	35,309.00	35,309.00	------------
Milwaukee	7.41	441,958.75	220,979.75	220,979.00	220,979.00	------------
Monroe	1.50	89,465.00	17,893.00	71,572.00	------------	71,572.00
Oconto	1.25	74,555.00	14,911.00	59,644.00	20,000.00	39,644.00
Oneida	0.80	47,715.00	9,543.00	38,172.00	20,000.00	18,172.00
Outagamie	1.75	104,376.25	20,875.25	83,501.00	40,000.00	43,501.00
Ozaukee	0.69	41,153.75	8,230.75	32,923.00	------------	32,923.00
Pepin	0.44	26,243.75	5,248.75	20,995.00	------------	20,995.00
Pierce	1.33	79,326.25	15,865.25	63,461.00	------------	63,461.00
Polk	1.73	103,183.75	20,636.75	82,547.00	60,000.00	22,547.00
Portage	1.49	88,868.75	17,773.75	71,095.00	71,095.00	------------
Price	0.88	52,486.25	10,497.25	41,989.00	------------	41,989.00
Racine	1.59	94,833.75	47,416.75	47,417.00	47,417.00	------------
Richland	1.23	73,361.25	14,672.25	58,689.00	------------	58,689.00
Rock	2.26	134,793.75	26,958.75	107,835.00	107,835.00	------------
Rusk	0.89	53,082.50	10,616.50	42,466.00	42,466.00	------------
St. Croix	1.49	88,868.75	17,773.75	71,095.00	35,000.00	36,095.00

TABLE VIa—Cont.

County	Pro Rata Share	Allotment of Residue to State and Co. Trunk Highways [Sec. 84.03 (9)]	Improvement of County Trunk Highway System 20%	Construction of S. T. Highway System		
				Total 80%	Federal Aid	State Aid
Sauk	1.78	$106,165.00	$21,233.00	$84,932.00	$50,000.00	$34,932.00
Sawyer	0.55	32,803.75	6,560.75	26,243.00	26,243.00	
Shawano	1.61	96,025.00	19,205.00	76,820.00	76,820.00	
Sheboygan	1.91	113,918.75	22,783.75	91,135.00		91,135.00
Taylor	0.92	54,872.50	10,974.50	43,898.00		43,898.00
Trempealeau	1.30	77,536.25	15,507.25	62,029.00	62,029.00	
Vernon	1.74	103,780.00	20,756.00	83,024.00		83,024.00
Vilas	0.45	26,840.00	5,368.00	21,472.00		21,472.00
Walworth	1.49	88,868.75	17,773.75	71,095.00		71,095.00
Washburn	0.95	56,661.25	11,332.25	45,329.00	24,000.00	21,329.00
Washington	1.24	73,957.50	14,791.50	59,166.00	59,166.00	
Waukesha	1.74	103,780.00	20,756.00	83,024.00	83,024.00	
Waupaca	1.75	104,376.25	20,875.25	83,501.00	83,501.00	
Waushara	1.28	76,343.75	15,268.75	61,075.00	61,075.00	
Winnebago	1.60	95,430.00	19,086.00	76,344.00	50,000.00	26,344.00
Wood	1.46	87,081.25	17,416.25	69,665.00	69,665.00	
Totals	100.00	$5,964,350.00	$1,377,169.00	$4,587,181.00	$2,945,723.00	$1,641.458,00

TABLE VII—SUMMARY OF MOTOR VEHICLE REGISTRATION—1905 TO 1925 INCLUSIVE

Year	Passenger Cars	Dealer's Licenses	Motor Trucks	Motor-cycles	Total of Motor Vehicles in use
1905	Moter vehicles licensed 1,492		Maximum number vehicles in operation 1,492		Probable number vehicles in operation 1,492
1906	1,174		2,666		2,600
1907	1,481		4,147		4,000
1908	2,045		6,192		6,000
1909	3,040		9,232		9,000
1910	5,979		15,211		14,000
1911	6,152		21,363		19,500
1912	24,578	1,052		4,060	* 31,794
1913	34,646	1,393		6,120	* 44,945
1914	53,160	1,202		7,881	* 64,647
1915	79,790	1,582		8,600	* 93,136
1916	115,637	1,970		8,958	130,577
1917	164,529	2,167		8,479	178,511
1918	189,636	1,500	6,816	7,238	208,635
1919	225,399	1,396	10,890	7,223	248,356
1920	277,093	1,946	16,205	8,002	307,138
1921	320,477	2,120	21,264	6,423	354,548
1922	361,062	2,135	26,788	5,917	* 400,172
1923	422,718	2,384	34,553	5,645	470,068
1924	474,413	2,710	54,413	3,942	543,784
1925	530,260	2,707	66,330	3,445	608,791

Each dealer assumed to have 3 cars.
1924 total includes 2,886 municipal and state cars.
1925 total includes 635 municipal and state cars.

TABLE VIIb—SHOWING MOTOR VEHICLE REGISTRATION BY CLASSES FOR YEARS 1924 AND 1925

(No record of registration by counties has been kept in 1924 and 1925)

1924 Registration—October 8, 1924

Passenger		Truck		Motorcycle		Dealers
A	156,765	A	17,095	A	2,109	2,705
B	134,378	B	17,576	B	1,782	@
C	92,398	C	6,299			3 each =
D	80,909	D	5,590			
E	4,204	E	2,117			
		F	617			
Totals	468,654		49,294		3,891	8,115

Passenger Cars	474,413
Trucks	54,413
Motorcycles	3,942
Dealers Cars	8,130
Municipal and State	2,886
Total (for year 1924)	543,784

1925 Registration

Passenger		Truck		Motorcycles		Dealers
A	34,213	A	26,320	A	1,827	2,707
B	257,299	B	23,208	B	1,618	@
C	118,591	C	7,300			3 each =
D	113,010	D	6,134			
E	7,147	E	2,675			
		F	693			
Totals	530,260		66,330		3,445	8,121

Passenger Cars	530,260
Trucks	66,330
Motorcycles	3,445
Dealers' Cars	8,121
Municipal and State	635
Total for year 1925	608,791

Note: For Table VIIa see page 208.

TABLE VIII—TRAFFIC COUNTS

Showing a summay of the traffic counts taken at various points on the State Trunk Highway System annually from 1919 to 1925, inclusive. It will be seen that in 1919
8.8% of the total traffic was tourist or out-of-state traffic.
3.4% was motor trucks.
2.9% was motorcycles.
8.2% was horse-drawn vehicles.

By following through the other years up to 1925 it may be noted that the foreign traffic has increased constantly from 8.8% in 1919, to 16.1% in 1925. The motor truck traffic has fluctuated but is higher in 1925 than in 1919; the motorcycles have decreased from 2.9% in 1919 to 0.4% in 1925; the horse-drawn vehicles have decreased from 8.2% in 1919, to 0.8% of the total in 1925. This table, while it does not show the total of any particular count, does show a general trend in the direction of heavy motorized traffic, and a steady increase in the percentage of out of the state cars.

1919 COUNTS

Date	No. of Traffic Stations	Wisconsin Cars	Foreign Cars	Motor Trucks	Motor Cycles	Horse drawn Vehicles	Totals
8–24	51	38,651	4,770	920	1,366	1,834	47,541
8–27	33	13,678	1,496	876	480	2,011	18,541
9–17	35	10,059	1,221	920	541	1,901	14,642
9–21	31	12,247	1,585	303	532	1,197	15,864
10–15	37	9,989	755	1,059	426	2,849	15,078
10–19	33	18,437	1,530	583	657	1,272	22,479
Total...	220	103,061	11,357	4,661	4,002	11,064	134,145
No. per	station......	468	52	21	18	50	609
Per cent	of total......	76.7	8.8	3.4	2.9	8.2	100.00

1920 COUNTS

Date	No. of Traffic Stations	Wisconsin Cars	Foreign Cars	Motor Trucks	Motor Cycles	Horse drawn Vehicles	Totals
7–25	55	52,242	7,542	1,052	1,248	1,682	63,766
8–11	48	23,530	3,466	1,853	694	2,221	31,764
8–22	50	44,992	5,475	925	1,260	1,586	54,238
9– 6	46	38,259	6,322	1,622	1,069	2,656	49,928
9–22	43	21,762	2,366	1,799	488	2,660	29,075
Total...	242	180,785	25,171	7,251	4,759	10,805	228,771
No. per	station......	748	104	30	20	45	947
Per cent	of total......	79.0	11.0	3.1	2.2	4.7	100.0

1921 COUNTS

Date	No. of Traffic Stations	Wisconsin Cars	Foreign Cars	Motor Trucks	Motor Cycles	Horse drawn Vehicles	Totals
7– 4	62	87,258	15,306	2,732	1,498	1,640	108,434
7–20	62	41,714	5,805	3,711	669	2,424	54,323
8–10	65	37,511	6,245	3,386	421	3,182	50,745
8–21	60	69,516	10,947	2,170	1,103	1,862	85,598
9– 5	66	76,263	15,438	3,042	1,184	2,585	98,512
9–18	43	37,468	2,773	2,066	282	2,071	44,660
9–21	17	8,198	798	902	102	389	10,389
Total...	375	357,928	57,312	18,009	5,259	14,153	452,661
No. per	Station......	955	153	48	14	38	1,208
Per cent	of total......	79.1	12.7	4.0	1.1	3.1	100.0

1922 COUNTS

Date	No. of Traffic Stations	Wisconsin Cars	Foreign Cars	Motor Trucks	Motor Cycles	Horse drawn Vehicles	Totals
6-21	60	38 ,912	4 ,482	5 ,453	522	2 ,594	51 ,963
7- 4	62	99.192	14 ,821	3 ,126	1 ,115	1 ,281	119 ,535
7-19	67	48 ,413	7 ,782	5 ,315	459	2 ,463	64 ,432
7-30	66	90 ,336	11 ,981	2 ,968	990	1 ,210	107 ,485
8- 8	65	47 ,048	8 ,269	5 ,286	551	2 ,405	63 ,559
8-20	63	91 ,755	13 ,058	2 ,697	1 ,047	1 ,207	109 ,764
9- 4	63	79 ,510	15 ,990	4 ,158	936	2 ,235	102 ,829
9-20	62	39 ,292	4 ,160	4 ,583	450	2 ,647	51 ,132
Total---	508	534 ,458	80 ,543	33 ,586	6 ,070	16 ,042	670 ,699
No. per	Station-----	1 ,050	160	66	12	32	1 ,320
Per cent	of total-----	79.5	12.1	5.0	0.9	2.5	100.0

1923 COUNTS

Date	No. of Traffic Stations	Wisconsin Cars	Foreign Cars	Motor Trucks	Motor Cycles	Horse drawn Vehicles	Totals
6-23	66	57 ,762	7 ,210	6 ,055	575	2 ,250	73 ,852
7- 4	67	128 ,660	15 ,675	3 ,317	1 ,346	1 ,130	150 ,128
7-18	65	61 ,191	11 ,444	5 ,826	537	2 ,245	81 ,243
7-29	66	111 ,417	16 ,060	2 ,947	1 ,156	922	132 ,502
8- 9	63	57 ,623	12 ,962	5 ,581	433	2 ,609	79 ,208
8-20	66	119 ,158	20 ,946	2 ,994	1 ,025	887	145 ,010
9- 3	66	112 ,742	29 ,445	4 ,177	1 ,179	2 ,431	149 ,974
9-19	63	49 ,509	5 ,807	4 ,873	321	2 ,150	62 ,660
Total---	522	698 ,062	119 ,549	35 ,770	6 ,572	14 ,624	874 ,577
No. per	Station-----	1 ,337	229	69	13	28	1 ,676
Per cent	of total-----	79.8	13.7	4.1	0.7	1.7	100.0

1924 COUNTS

Date	No. of Traffic Stations	Wisconsin Cars	Foreign Cars	Motor Trucks	Motor Cycles	Horse drawn Vehicles	Totals
6-18	64	61 ,741	8 ,191	7 ,777	476	2 ,356	80 ,541
7- 4	65	160 ,825	31 ,870	3 ,875	1 ,236	698	198 ,504
7-16	64	65 ,770	12 ,907	7 ,440	554	1 ,607	88 ,278
7-27	65	147 ,953	22 ,884	3 ,233	1 ,207	587	175 ,864
8- 6	66	72 ,236	14 ,761	6 ,735	534	1 ,691	95 ,957
8-17	65	146 ,268	25 ,968	3 ,001	958	561	176 ,756
9- 1	66	117 ,016	33 ,181	5 ,041	659	1 ,313	157 ,210
9-17	64	63 ,396	7 ,976	7 ,158	374	1 ,891	80 ,795
Total---	519	835 ,205	157 ,738	44 ,260	5 ,998	10 ,704	1 ,053 ,905
No. per	Station-----	1 ,608	304	85	12	20	2 ,029
Per cent	of total-----	79.2	15.0	4.2	0.6	1.0	100.0

1925 COUNTS

Date	No. of Traffic Stations	Wisconsin Cars	Foreign Cars	Motor Truks	Motor Cycles	Horse drawn Vehicles	Totals
6-17	69	68,036	9,435	7,866	452	1,600	87,389
7- 4	71	176,260	40,163	4,542	1,125	551	222,641
7-15	67	69,855	16,095	7,775	399	1,222	95,346
7-26	71	155,953	28,062	3,926	797	510	189,248
8- 5	71	74,897	18,413	8,502	366	1,487	103,665
8-16	71	167,494	31,892	3,999	941	525	204,851
8-26	67	70,078	16,490	7,698	453	1,408	96,127
9- 7	71	160,921	38,558	6,149	988	1,309	207,923
9-16	70	76,073	10,205	8,515	357	1,471	96,621
Total	62.8	1,019,567	209,313	58,972	5,878	10,083	1,303,811
No. per	Station	1,625	334	94	9	16	2,078
Per cent	of total	78.2	16.1	4.5	0.4	0.8	100.0

TABLE IX—STATE LINE TRAFFIC COUNT OF FOREIGN CARS—1925

S. T. H. No.	July 3		July 11		July 19		July 27		Aug. 4		Aug. 12		Aug. 20		Total	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
15	1,823	564	2,305	1,442	2,321	2,549	1,188	1,124	1,163	974	1,137	1,108	1,031	996	10,968	8,757
57	673	153	344	142	317	474	146	174	323	291	208	143	253	219	2,264	1,596
83	1,431	184	1,372	426	1,284	1,659	449	463	472	397	307	304	253	192	5,568	3,625
12	678	95	524	228	549	1,273	150	323	124	292	128	246	317	381	2,470	2,838
89	823	172	581	343	930	1,183	397	371	306	292	354	323	374	324	3,765	3,008
140	19	13	Discontinued			----	----	----	----	----	----	----	----	----	19	13
10	733	117	478	361	546	517	354	261	353	228	366	321	297	325	3,127	2,130
31	177	48	81	41	107	46	83	60	58	59	88	66	364	293	958	613
81	94	130	146	131	93	130	117	201	148	183	70	74	59	178	727	1,027
80	68	51	177	130	235	212	99	113	67	55	70	49	71	96	787	706
11–20	185	210	310	280	410	305	252	236	282	217	272	243	256	228	1,967	1,719
35–23	77	63	58	51	103	90	28	45	49	40	43	63	50	45	408	397
61–133	None Taken			----	----	----	----	----	----	----	----	----	----	----	----	----
19	66	102	27	42	71	60	69	68	65	32	53	57	54	56	405	417
82	None Taken			----	----	----	----	----	----	----	----	----	----	----	----	----
29–33	117	58	64	60	35	37	20	27	38	52	28	41	37	37	339	312
54	73	44	55	29	90	79	68	44	41	37	74	68	68	37	469	338
Ferry–Wabasha	9	12	9	6	6	15	5	6	1	2	*5	*5	8	7	43	53
Stockholm	8	5	4	4	8	7	4	4	6	2	3	5	13	2	46	29
46	383	246	344	301	958	900	290	277	275	382	399	372	484	402	3,133	2,880
18	122	54	75	57	176	227	101	62	73	76	109	76	84	110	740	662
12	1,165	452	637	456	940	1,052	434	417	424	395	318	340	205	329	4,123	3,441
64	562	88	424	251	106	60	92	111	112	125	127	154	128	148	1,551	957
14–35	835	309	583	285	1,380	1,376	406	338	423	370	383	291	412	346	4,422	3,315
152	5	0	Discontinued			----	----	----	----	----	----	----	----	----	5	0
105	18	14	* 15	* 12	* 15	* 12	20	18	25	18	21	22	26	23	140	119
10	438	325	344	308	264	264	791	692	185	180	231	195	233	205	2,486	2,169
Hurley	853	801	1,225	1,099	*1,000	* 950	Neglected to take			----	----	----	----	----	3,078	2,850
26	54	97	50	64	164	177	221	176	119	130	231	195	164	149	1,003	988
55	61	37	* 61	* 37	108	72	37	27	42	38	31	39	88	54	428	304
69-W	359	360	426	490	549	478	306	317	285	294	333	360	266	254	2,524	2,553
69-E	511	512	686	568	1,099	925	431	451	188	203	450	419	249	368	3,614	3,446
57-N	94	54	274	203	94	108	57	57	81	100	64	63	54	79	718	664
15-N	274	203	274	203	85	111	99	92	47	37	139	99	190	66	1,108	811
Total	12,788	5,573	11,953	8,050	14,043	15,348	6,714	6,555	5,775	5,501	6,042	5,741	6,088	5,949	63,403	52,717

* Estimate
Number of foreign cars entering state daily—9,060

TABLE VIIa—MOTOR VEHICLE REGISTRATION BY COUNTIES FOR YEARS 1914, 1918, 1922, AND 1923

FOR 1924 AND 1925 SEE TABLE VIIb

County	1914 Registr. Autos & Trucks	% of State Total	1918 Registration			% of State Total	1922 Registration			% of State Total	1923 Registration			% of State Total
			Autos	Trucks	Total		Autos	Trucks	Total		Autos	Trucks	Total	
Adams	110	.21	602	1	603	.31	1,118	40	1,158	.30	1,292	58	1,350	.30
Ashland	189	.36	965	37	1,002	.51	2,057	88	2,145	.55	2,535	130	2,665	.58
Barron	531	1.00	2,765	58	2,823	1.44	5,096	213	5,309	1.37	5,624	301	5,925	1.30
Bayfield	110	.21	708	10	718	.37	1,343	80	1,423	.37	1,642	136	1,778	.39
Brown	929	1.75	3,329	156	3,485	1.77	7,832	562	8,394	2.16	9,370	798	10.168	2.22
Buffalo	387	.73	1,795	30	1,825	.93	2,522	172	2,694	.69	2,878	200	3,078	.67
Burnett	132	.25	737	16	753	.38	1.516	81	1.597	.41	1,496	94	1,590	.35
Calumet	570	1.07	1,985	63	2,048	1.04	3,168	160	3,328	.86	3,528	193	3,721	.81
Chippewa	557	1.05	2,544	52	2,596	1.32	4,942	239	5,181	1.34	5,742	330	6,072	1.33
Clark	549	1.03	2,639	45	2,684	1.37	4,836	181	5,017	1.29	5,557	212	5,769	1.26
Columbia	926	1.74	3,131	62	3,193	1.63	5,605	319	5,924	1.53	6,100	392	6,492	1.42
Crawford	233	.44	1,247	14	1,261	.64	2,389	80	2,469	.64	2,698	121	2,819	.62
Dane	2,977	5.60	9,885	203	10,088	5.14	17,128	1,283	18,411	4.75	19,335	1,657	20,992	4.60
Dodge	1,600	3.01	5,616	140	5,756	2.93	8,601	449	9,050	2.33	9,647	552	10,199	2.23
Door	324	.61	1,524	82	1,606	.82	2,786	300	3,086	.80	3,193	319	3,512	.77
Douglas	420	.79	1,802	27	1,829	.93	4,016	163	4,179	1.08	5,024	303	5,327	1.16
Dunn	582	1.10	2,373	37	2,410	1.23	4,216	180	4,396	1.13	4,867	236	5,103	1.12
Eau Claire	599	1.13	2,275	73	2,348	1.20	4,710	272	4,982	1.28	5,516	378	5,894	1.29
Florence	53	.10	169	7	176	.09	404	13	417	.11	518	17	535	.12
Fond du Lac	1,667	3.14	5,287	150	5,437	2.77	9,590	550	10,140	2.61	10,941	709	11,650	2.55
Forest	51	.10	234	11	245	.13	796	52	848	.22	1,019	61	1,080	.24
Grant	1,370	2.57	4,749	138	4,887	2.49	7,730	515	8,245	2.13	8,381	615	8,996	1.97
Green	893	1.68	3,114	65	3,179	1.62	4,853	374	5,227	1.35	5,092	415	5,507	1.21
Green Lake	459	.86	1,605	68	1,673	.85	3,575	152	3,727	.96	2,951	204	3,155	.69
Iowa	647	1.22	2,499	33	2,532	1.29	2.637	124	2,761	.71	3,822	162	3,984	.87
Iron	36	.07	280	20	300	.15	605	60	665	.17	826	78	904	.20
Jackson	298	.56	1,484	16	1,500	.76	2,577	126	2,703	.70	2.803	156	2,959	.65
Jefferson	1,015	1.91	3,677	147	3,824	1.95	6,461	533	6,994	1.80	7,289	668	7,957	1.74
Juneau	237	.44	1,274	13	1,287	.65	2,559	102	2,661	.69	*3,835	138	*3,973	.87
Kenosha	784	1.47	2,720	119	2,839	1.45	5,708	416	6,124	1.58	7,326	575	7,901	1.73
Kewaunee	343	.64	1,480	24	1,504	.77	2,541	122	2,663	.69	2,788	145	2,933	.64
La Crosse	978	1.84	3,097	90	3,187	1.62	6,492	376	6,868	1.77	7,492	600	8,092	1.77
Lafayette	601	1.13	2,553	67	2,620	1.33	3,516	161	3,677	.95	3,983	183	4,166	.91
Langlade	232	.43	960	41	1,001	.51	2,279	96	2,375	.61	2,641	113	2,754	.66
Lincoln	245	.46	949	38	987	.50	2.344	156	2,500	.64	2,886	201	3,087	.67

Manitowoc	1,085	2.04	4,295	108	4,408	2.24	7,501	413	7,914	2.04	9,085	552	9,637	2.11
Marathon	916	1.72	3,783	101	3,884	1.98	7,785	315	8,100	2.09	9,219	426	9,645	2.11
Marinette	304	.57	1,329	51	1,380	.70	3,336	191	3,527	.91	4,089	224	4,313	.94
Marquette	259	.49	1,117	8	1,125	.57	1,613	60	1,673	.43	2,040	66	2,106	.46
Milwaukee	8,800	16.56	23,684	1,994	25,678	13.07	54,515	7,496	62,011	16.01	68,304	10,026	78,330	17.14
Monroe	480	.90	2,394	28	2,422	1.23	4,467	189	4,656	1.20	4,903	244	5,147	1.13
Oconto	275	.52	1,430	22	1,452	.74	3,031	152	3,183	.82	3,593	178	3,771	.83
Oneida	105	.20	710	16	726	.37	1,705	140	1,845	.48	2,178	183	2,361	.52
Outagamie	975	1.83	3,799	177	3,976	2,02	7,649	628	8,277	2.14	8,772	739	9,511	2.08
Ozaukee	431	.81	1,608	100	1,708	.87	2,786	354	3,140	.81	3,037	449	3,486	.76
Pepin	158	.30	714	3	717	.36	1,237	57	1,294	.33	1,402	67	1,469	.32
Pierce	505	.95	2,252	29	2,281	1.16	3,761	148	3,909	1.01	4,312	196	4,508	.99
Polk	432	.81	2,297	27	2,324	1.18	4,323	158	4,481	1.16	5,019	203	5,222	1.14
Portage	501	.94	2,021	40	2,061	1.05	4,047	171	4,218	1.09	4,520	202	4,722	1.03
Price	117	.22	702	31	733	37	1,577	86	1,663	.43	1,993	104	2,097	.46
Racine	1,483	2.79	4,627	308	4,935	2.51	9,480	914	10,394	2.68	11,882	1.102	12,984	2.84
Richland	613	1.15	2,116	44	2,160	1.10	2,602	189	2,791	.72	3,408	225	3,633	.79
Rock	1,843	3.47	5,354	168	5,522	2.81	11,029	726	11,755	3.06	12,790	1.064	13,854	3.03
Rusk	153	.29	586	12	598	.30	1,760	76	1,836	.47	2,046	99	2,145	.47
St. Croix	548	1.03	2,313	34	2,347	1.19	4,038	151	4,189	1.08	4,486	184	4,670	1.02
Sauk	1,092	2.05	3,398	137	3,535	1.80	5,620	401	6,021	1.55	6,257	492	6,749	1.48
Sawyer	43	.08	266	1	267	.14	722	43	765	.20	965	46	1,011	.22
Shawano	523	.98	2,506	32	2,538	1.29	4,724	128	4,852	1.25	5,368	182	5,550	1.21
Sheboygan	1,489	2.80	4,794	211	5,005	2.55	8,945	669	9,614	2.48	11,209	798	12,007	2.63
Taylor	189	.35	715	20	735	.37	1,677	67	1,744	.45	1,984	85	2,069	.45
Trempealeau	500	.94	2,463	37	2,500	1.27	4,667	217	4,884	1.26	* 4,623	292	* 4,915	1.08
Vernon	759	1.43	2,497	25	2,522	1.28	4,984	171	5,155	1.33	5,571	210	5,781	1.27
Vilas	44	.08	296	11	307	.16	786	88	874	.21	988	113	1,101	.24
Walworth	1,370	2.58	3,808	114	3,922	2.00	6,278	495	6,773	1.75	6,951	521	7,472	1.63
Washburn	96	.18	527	14	541	.28	1,210	56	1,266	.33	1,406	79	1,485	.32
Washington	813	1.53	3,135	106	3,241	1.65	4,910	471	5,381	1.38	5,391	609	6,000	1.31
Waukesha	1,327	2.50	4,417	303	4,720	2.40	7,754	1,038	8,792	2.27	8,824	1,239	10,063	2.20
Waupaca	851	1.60	3,811	51	3,862	1.97	6,089	347	6,436	1.66	6,803	455	7,258	1.59
Waushara	498	.94	1.892	41	1,933	.98	2,806	200	3,006	.78	3,056	213	3,269	.72
Winnebago	1,388	2.61	3,839	196	4,035	2.05	7,885	725	8,610	2.22	9,631	868	10,499	2.30
Wood	562	1.06	2,088	63	2,151	1.10	5,002	228	5,230	1.35	5,748	315	6,063	1.33
Totals	53,161	100.00	189,636	6,816	196,452	100.00	360,849	26,748	387,597	100.00	422,490	34,500	456,990	100.00

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* Doubtful.

TABLE X—SUMMARY OF ACCIDENTS STATE TRUNK HIGHWAYS 1922–1925

	May-Dec. 1922	Jan.-Dec. 1923	Jan.-Dec. 1924	Jan.-Dec. 1925
Total number of accidents	1,069	1,820	1,459	1,683
Total number of people involved (est.)	3,562	6,424	5,528	6,528
Total number of people killed	94	172	163	199
Total number of people seriously injured	312	461	504	512
Total number of people slightly injured	935	1,500	1,425	1,499
Classification with reference to location				
On straight road	718	1,228	875	1,060
At curves and corners	185	324	304	301
At railroad crossings	66	68	69	56
On hills	----------	36	72	80
At crossroads	62	106	96	163
At other places	38	58	43	23
Classification with reference to cause				
Reckless driving	631	752	512	683
Passing other cars in driveways	----------	190	214	222
Improper or glaring lights	21	142	110	109
Broken car mechanism	30	102	81	68
Loose gravel	----------	28	48	45
Intoxicated drivers	36	103	88	70
Weather conditions	43	138	115	152
Parking or driving on wrong side of road	6	52	83	80
Narrow bridges and culverts	1	43	29	19
Miscellaneous causes	296	254	176	235

TABLE XI—COUNTY TRUNK HIGHWAYS

Showing by years County Trunk Highways maintained, total expenditures, per mile and the number of patrolmen employed.

County	1918	1919	1920	1921	1922	1923	1924	1925
Adams	--------	--------	14	14	30	25	85	85.9
Ashland	38	40	36.75	37.75	40	50	30	61.4
Barron	0	--------	100	145	170	189	189	238.6
Bayfield	67	67	67	95	123	117	117	124.7
Brown	--------	140	140	160	170	157	122	122.4
Buffalo	103	151	170	222	185	222	172	183.1
Burnett	26	43	67	87	87	22	60	79.0
Calumet	--------	84	75	85	85	85	84	70.8
Chippewa	--------	82	202	212	246	222.5	225	311.8
Clark	66	106	107	108	135	116	103	104.8
Columbia	--------	35	35	47	102	136.3	148	8.
Crawford	--------	--------	105	135	144	181.0	158	209.
Dane	--------	136	158	180	180	180.0	200	240.
Dodge	--------	--------	--------	--------	--------	171.7	275	272
Door	--------	50	100	100	150	118	124	17
Douglas	50	65	70	91	136	196.5	200	24
Dunn	--------	34.25	109.25	132.25	126.25	200.5	226	2
Eau Claire	--------	69	83.3	112.3	150	137.4	128	1
Florence	16	20	27	38	54	49	34	
Fond du Lac	--------	95	217	244	244	232	215	
Forest	30	36	86	102	95	100	41	
Grant	62	68	210	253	290	317.4	279	
Green	24	48	77	148	132	132	113	
Green Lake	--------	19	25	34.5	52	69.3	80	
Iowa	115	115	115	140	140	114.1	110	
Iron	--------	--------	--------	--------	--------	18	6	
Jackson	--------	91.5	101.5	103.5	103.5	199	131	
Jefferson	--------	--------	--------	45	72	89	36	
Juneau	--------	--------	136	136	136	143	115	
Kenosha	36	65	87	104	135	100	110	
Kewaunee	--------	134	134	143	143	138	123	
La Crosse	194.75	194.75	194.75	194.75	194.75	197	19	
Lafayette	--------	81	186	280	234	252.7	24	
Langlade	149	177	135	156	132	185	107	
Lincoln	--------	--------	136	145	180	184	1	
Manitowoc	--------	90	110	124	124	127		
Marathon	128	128	128	134	152	114.5	1	
Marinette	--------	45	54	62	75	204		
Marquette	16.5	16.5	16.5	16.5	16.5	16.5		
Milwaukee	82	110	120	135	150	138.5		
Monroe	--------	171	189	251	252	280		
Oconto	--------	110	117	114	125	135		
Oneida	29	38	57	57	57	103		
Outagamie	--------	125	125	175	175	177		
Ozaukee	--------	39	55	69	95	95		
Pepin	28	38	48	48	48	48		
Pierce	--------	107	121	121	121	123		
Polk	--------	140	198	243	325	269		
Portage	--------	--------	36	61	80	68.		
Price	--------	83	117	79	96	122		

TABLE XI—Cont.

County	1918	1919	1920	1921	1922	1923	1924	1925
Racine	70	100	123	126	140	155	93	93.4
Richland	68	68	102	121.7	180	198.4	214	224.1
Rock	187	202	217	232	160	160	65	90.0
Rusk	48	51	53	56	139	95	70	176.9
St. Croix	--------	100	100	100	100	136	138	138.3
Sauk	--------	--------	--------	--------	106	191.1	141	130.3
Sawyer	--------	88	120	120	152	138.5	112	120.0
Shawano	--------	186	242	255	255	267	244	252.5
Sheboygan	75	320	320	320	320	220	225	252.0
Taylor	--------	--------	104	110	132	122	103	138.0
Trempealeau	--------	124	136	167	180	212	161	182.8
Vernon	98	129	176	224	230	246	177	221.3
Vilas	55	58	67	67	48	67	53	60.5
Walworth	--------	121	127	137	170	141.5	157	144.9
Washburn	--------	84.5	93	105	133	139.5	114	140.1
Vashington	--------	68	68	189	189	200	150	151.0
Vaukesha	150	180	320	320	320	155	166	248.4
aupaca	--------	87	87	87	120	185	165	235.5
ushara	--------	--------	--------	--------	--------	--------	50	58.9
nebago	--------	100	100	123	123	102	92	92.3
d	10	35.5	160	200	200	168.45	195	183.6
Totals	2,021.25	5,589.00	7,713.05	8,979.25	9,885.00	10,367.1	*9,369	10,865.
Ex- itures	475,000	1,229,867	1,444,827	1,875,715	2,290,804	2,152,465	*2,103,337	**2,192,654
iture ile	235	219	194	208	231	208	215	200
men	232	705	970	1,123	1,236	1,290	1,165	1,320

ase in mileage in 1924 is due to the fact that the State Trunk Highway System was increased miles in 1923 and the greater part of this addition was taken from the County Trunk High-

de and Florence estimate only.

XII—CUBIC YARDS OF MATERIAL REQUIRED FOR VARIOUS WIDTHS AND DEPTHS OF GRAVEL SURFACING

crown section used for calculation of table. Depth is at center.

	9′	12′	15′	18′	20′	24′	26′	28′	30′	32′
	0.07	0.10	0.12	0.14	0.16	0.20	0.21	0.23	0.24	0.26
	391	522	652	782	868	1,042	1,125	1,215	1,304	1,390
	0.09	0.12	0.15	0.18	0.21	0.25	0.27	0.29	0.30	0.33
	488	651	815	976	1,085	1,304	1,414	1,518	1,630	1,764
	0.11	0.15	0.19	0.22	0.25	0.30	0.32	0.35	0.37	0.40
	587	782	975	1,174	1,302	1,565	1,695	1,825	1,950	2,086
	0.13	0.17	0.22	0.26	0.29	0.35	0.37	0.40	0.44	0.46
	684	912	1,140	1,368	1,520	1,824	1,975	2,128	2,280	2,432
	0.15	0.20	0.25	0.30	0.33	0.39	0.43	0.46	0.50	0.53
	782	1.042	1.032	1.564	1.737	2.084	2.254	2.435	2.605	2.780
	0.17	0.22	0.28	0.34	0.37	0.44	0.48	0.52	0.56	0.59
	880	1.174	1.464	1.760	1,955	2,346	2,542	2,732	2,928	3,126
	18	0.25	0.31	0.36	0.42	0.49	0.53	0.58	0.62	0.70
	[illegible]	1,302	1,630	1,952	2,170	2,608	2,820	3,036	3,260	3,686

TABLE XIII—TABLE OF CONCRETE PROPORTIONS

Amount of Cement, Sand and Stone Required to Make One Cubic Yard of Compacted Mortar or Concrete of Various Proportions.
(Based on a sack of cement = one cubic foot.)

Proportion (By Volume)			Quantities Required to Make one cubic yard			Remarks
Cement	Sand	Stone	Cement -Sacks	Sand Cu. Yds.	Stone Cu. Yds.	
1	--------	--------	30.00	--------	--------	Fuller's Rule for approx. determination of quantities per cu. yd. $P = \frac{42}{c+s+g}$ =No. Sacks of cement per cu. yd. of concrete. Where— c = no. parts cement s = no. parts sand g = no. parts stone Then $\frac{P \times s}{27}$ =No. cu. yds. sand and $\frac{P \times g}{27}$ =No. cu. yds. stone Amount of water varies with nature of m terial and plasticity of mixture. Us amount =26 to 33 gals.
1	1	--------	19.54	0.73	--------	
1	1½	--------	15.40	0.85	--------	
1	2	--------	12.85	0.95	--------	
1	3	--------	9.56	1.06	--------	
1	4	--------	7.60	1.13	--------	
1	5	--------	6.32	1.17	--------	
1	6	--------	5.40	1.20	--------	
1	1	1½	11.90	0.44	0.66	
1	1	2	10.52	0.39	0.78	
1	1½	2½	8.36	0.46	0.77	
1	1½	3	7.64	0.43	0.85	
1	2	3	6.96	0.52	0.77	
1	2	4	6.04	0.45	0.90	
1	2½	4	5.56	0.52	0.83	
1	2½	5	4.96	0.46	0.92	
1	3	6	4.24	0.47	0.94	
1	4	8	3.24	0.48	0.96	

REMARKS (Cont.)

The exact quantities of materials required to make a cu. yd. of concrete will vary with the perc
of voids in the sand and stone. The above quantities are for average conditions and are intended
a guide for making estimates.

After figuring material by above table, about 3% should be added to cover wastage. This dep
care exercised when handling.

If the course aggregate be uniformly graded in size, add 5 to 8% to amount of material shown
if well graded from fine to coarse size, subtract 5 to 8% from amount shown in table. Materia
posed to be measured loose. For average conditions, one sack of cement (96 lbs.) may be con
equal to one cubic foot.

TABLE XIV.—TABLE SHOWING LOCATION AND TERMINI OF TRUNK HIGHWAYS.

State Trunk Highway No.	Location
10	Beloit–Wausau–Superior
11	Dubuque–La Crosse–Superior
12	Genoa Junction–Madison–St. Paul
13	Beloit–Kilbourn–Superior
14	Niagara–St. Croix Falls
15	Illinois State Line–Milwaukee–Marinette
16	Manitowoc–Chippewa Falls
17	Illinois State Line–Milwaukee–Sister Bay
18	Manitowoc–Stevens Point–Prescott
19	Milwaukee–Madison–Prairie du Chien
20	Racine–East Dubuque
21	Oshkosh–North Tomah
22	Oconto–Wautoma
23	Sheboygan–Kilbourn–Dubuque
24	Ashland–Clear Lake–Hudson
25	Durand–Jct. No. 48 Near Rice Lake
26	Beloit–Oshkosh–State Line (Vilas County)
27	Prairie du Chien–Superior
28	Beaver Dam–Sheboygan
29	Watertown–La Crosse
30	Milwaukee–Madison

31	Illinois State Line at Monroe–Manitowoc
32	Sheboygan–Eagle River
33	Waupun–La Crosse
34	Berlin–Omro–Butte des Morts
35	Dubuque–Superior
36	Milwaukee–Big Foot (Illinois State Line)
37	Alma–Eau Claire
38	Racine–Ryan Road (River and Howell Road)
39	Albany–Mineral Point–Edmund
40	Elk Mound–Junction No. 27 North of Bruce
41	Milwaukee–Madison–La Crosse
42	Cedar Grove–No. 18 West of Manitowoc
43	Kenosha–Burlington
44	North Leeds–Oshkosh
45	Wisconsin Rapids–Junction City–Knowlton
46	Red Wing–Amery to No. 14
47	Appleton–Woodruff
48	Rice Lake Grantsburg
49	Waupun–Wittenberg
50	Kenosha–Delavan
51	Downsville–Ellsworth
52	Wausau–Aniwa
53	Neillsville–Fountain City
54	Algoma–Winona
55	Milwaukee–Alvin–State Line
6	Richland Center–Genoa
7	Illinois State Line–Niagara
	No. 41 near Sextonville–Mauston
	Monroe–Goerkes Corners
	Ulao–Prairie du Chien
	Milwaukee–Cassville
	Junction No. 20–Mineral Point
	Merrill–Eagle River
	Marinette–Stillwater
	New Richmond–River Falls
	Stevens Point–Rosholt–No. 49
	Junction No. 12 (Walworth County)—Plymouth
	Port Washington–Fox Lake
	Menominee River–Brule (Florence County)
	Eagle River–Grantsburg
	auston–Melrose
	o. 70 (Vilas County)—Plum Lake
	nesville–Ingram
	x Point–Junction No. 83 (North Lake)
	rham Corners (Waukesha County)—Junction 50 (Kenosha County)
	eton–Bear Creek
	y–Hayward
	Bay–Sister Bay
	onie Junction–Glenwood–To No. 64
	State Line (Hazel Green)–Necedah
	State Line (Gratiot)–Portage
	o–De Soto
	State Line (Salem)–Junction No. 15 (Hartford)
	lle–Boltonville
	Eau Claire
	k–Ogema
	Falls–Grantsburg
	o. 35 (Buffalo County)–Mondovi
	te Line (Big Foot)–Waterloo
	onia
	rd
	oreb
	Trempealeau County) Eau Claire
	ouglas
	ont

96	S. T. H. No. 103–Wrightstown
97	Marshfield–Goodrich
98	Spencer–Greenwood
99	Mukwonago–Eagle
100	Milwaukee County Loop
101	Armstrong Creek–Florence
102	Chelsea–Spirit
103	Seven Mile Creek–Brandon
104	Brodhead–North to No. 59
105	Junction No. 35–West (near Superior)
106	Fort Atkinson–Oregon
107	Junction No. 153–Junction No. 16 (Marathon County)
108	West Salem–Melrose
109	Watertown–Woodland
110	Junction No. 13–Junction No. 24 (Ashland County)
111	Catawba–Phillips
112	Benoit–No. 13 South of Barksdale
113	Madison–Lodi–Baraboo
114	Brillion–Menasha
115	(Not in use)
116	Chippewa Falls–Prescott
117	Junction No. 47 to No. 22 (East of Shawano)
118	Juneau to No. 60
119	Milwaukee–Pewaukee (Lake Street)
120	Racine–Burlington
121	Whitehall–Independence
122	Upson–Saxon
123	Baraboo–Devils Lake
124	Junction No. 11–Junction No. 64 (East of Bloomer)
125	(Not in use)
126	Belmont–Junction No. 61
127	Pittsville–Dexterville (Wood County)
128	Elmwood–Spring Valley
129	Potosi–South
130	Junction No. 28–Junction No. 60 (Iowa–Richland Cos.
131	Gays Mills–No. 35
132	Boscobel–Mt. Hope
133	Bloomington–Cassville
134	Cambridge–London
135	Packwaukee–Junction No. 29
136	Prairie du Sac–North Freedom–No. 33
137	Junction No. 28–Junction No. 39 (Iowa County)
138	Junction No. 59–Junction No. 106 (near Stoughton)
139	Cavour–North
140	Illinois State Line–No. 20 (Via Clinton)
141	No. 29–No. 33–Columbia County
142	No. 71 to No. 12 (near Wilton)
143	Cedarburg–Junction No. 60
144	Cedar Grove–West Bend
145	Weyauwega–North
146	Kewaunee–Bellevue
147	Mishicot–Cooperstown
148	Valders–Cato
149	Cleveland–Kiel
150	Neenah–Winchester
151	Brick Yard Road–Appleton
152	Danbury–West
153	Mosinee–Stratford
154	No. 33 (Near Ableman)–No. 58 (South of L
155	South Germantown Cut-off
156	Junction No. 47–Junction No. 26 (Clinton
157	Lena–Suring (Oconto County)
158	Junction No. 64–Crivitz (Marinette Cou
159	No. 12 (South of Baraboo)–No. 123 (nea
160	Green Bay–Angelica
161	Symco–Amherst Junction
162	Middle Ridge–West Salem–Trempealeau
163	Two Rivers–Luxemburg
164	Waukesha–Templeton

TABLE XV—TABLE SHOWING THE TRUNK HIGHWAYS WHICH PASS THROUGH EACH OF THE COUNTIES

County	Numbers of State Trunk Highways in County
Adams	13-21-73-135
Ashland	10-13-24-77-110
Barron	11-14-24-25-48
Bayfield	10-13-24-112
Brown	15-16-32-54-57-78-96-146-160
Buffalo	18-35-37-53-54-88
Burnett	35-48-70-87-152
Calumet	18-31-55-57-114
Chippewa	11-16-27-40-64-116-124
Clark	12-13-16-18-53-73-98
Columbia	10-13-23-29-31-33-44-60-73-81-113-135-141
Crawford	11-19-27-35-60-131
Dane	10-12-13-19-30-31-41-73-81-92-106-113-134-138
Dodge	15-19-26-28-29-31-33-49-60-67-68-73-109-118
Door	17-78
Douglas	10-11-13-27-35-105
Dunn	12-25-40-51-64-79-85-116
Eau Claire	11-12-27-37-85-93
lorence	69-101-139
ond du Lac	15-23-26-31-44-49-55-67-103
orest	14-32-55-101-139
ant	11-19-20-23-35-61-80-129-132-133
een	20-31-39-59-61-81-92-104
en Lake	23-34-44-49-73
a	19-23-39-41-62-80-81-130-137
	10-77-122
on	12-18-27-53-54-71-108
son	12-19-26-30-41-59-89-90-106-109-134
	12-21-29-33-58-71-80-94
na	15-17-43-50-57-75-83
ee	17-54-78-96-146-163
e	11-29-33-35-41-108-162
	20-23-61-62-80-81-126
	26-47-55-63-64
	10-14-63-64-86-91
	16-17-18-31-32-42-57-147-148-149-163
	10-13-16-45-49-52-97-98-107-153
	14-15-57-64-158
	10-23-73-135
	15-17-19-30-36-38-41-55-57-61-74-75-100-119-155
	12-21-27-29-33-71-142
	15-22-32-57-64-157
	10-14-26-32-47-63-70
	15-18-26-47-54-55-76-96-151-156-160
	17-57-60-68-84-143
	18-25-35-85
	18-35-46-51-116-128
	14-24-35-46-48-87
	10-18-22-45-49-54-66-73-161
	13-14-70-86-102-111
	15-17-20-36-38-43-57-75-83-120
	41-56-58-60-80-130-154
	10-13-20-26-59-61-73-92-104-138-140
	14-27-40-73
	12-24-35-46-64-65-79-116
	12-13-23-29-33-41-58-60-81-113-123-136-154-159
	24-27-70-77
	16-22-26-32-47-52-55-117-156-160
	7-23-28-32-42-57-67-144
	-64-73-97-102

TABLE XV. (Continued)

County	Numbers of State Trunck Highways in County
Trempealeau	11–18–27–35–53–54–93–121–162
Vernon	11–27–33–35–41–56–80–82
Vilas	10–26–32–63–70–72
Walworth	12–20–36–50–59–61–67–83–89
Washburn	11–24–27–70
Washington	15–28–55–60–68–83–84–144–155
Waukesha	15–19–30–36–41–55–59–61–67–74–75–83–99–119–155–164
Waupaca	18–22–26–49–54–76–95–145–156–161
Waushara	10–21–22–49–73
Winnebago	15–18–21–34–44–95–114–150–151–26
Wood	13–18–45–54–73–97–127

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